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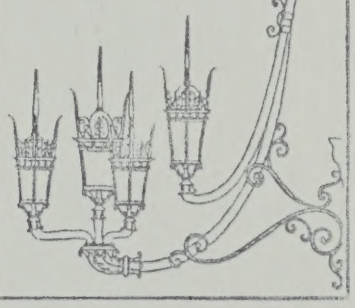

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APPENDIX - VOLUME II

Worcester Commuter Rail Extension Project

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DRAFT Environmental Impact Report

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Submitted to:
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Submitted by:
Massachusetts Bay Transportation Authority

November 1994

APPENDICES - VOLUME II

2.0 CTPS RIDERSHIP/PARKING DEMAND

3.0 NOISE AND VIBRATION

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PRINTED ON RECYCLED PAPER

SECTION 2.0

CTPS RIDERSHIP/PARKING DEMAND

MEMORANDUM

TO: Files **June 29, 1994**

FROM: Thomas J. Humphrey, Chief Planner

RE: Changes in conditions in Worcester Rail Corridor Since 1975.

Commuter rail service on the route of the proposed Worcester extension was last operated in October 1975. At that time, service consisted of one round trip per day, serving no stations except Worcester west of Framingham, and carrying an average of 15 passengers per day in each direction. A detailed history of this service is presented in a separate memorandum.

The negligible ridership on Worcester commuter rail service in 1975 cannot be taken as an indication that restored service on this route would have similarly low demand. Since 1975, escalating housing prices in inner suburbs have contributed to substantial growth in work trips to Boston from communities 25 to 50 miles away, including those between Framingham and Worcester. In corridors where commuter rail service is currently provided, it has captured a large share of these new work trips.

Upgraded tracks and stations, expanded parking facilities, and new rolling stock have been essential to commuter rail ridership growth. The most recent commuter rail service to Worcester was operated by the bankrupt Penn Central Company. Penn Central and its predecessor, the New York Central Railroad, had been seeking for years to discontinue all passenger service on the Worcester route, and had been unreceptive to subsidy proposals. Most of the coaches used on the line were antiquated and were in fair to poor condition. Stops in the towns between Framingham and Worcester (Ashland, Southborough, Westborough, and Grafton) had all been discontinued in 1960. Limited parking capacity was provided at the Worcester station.

Although construction schedules may require restored Worcester commuter rail service to operate with no intermediate stations west of Framingham, as it did in 1975, long-range plans anticipate up to five intermediate stations, all with large parking lots. The entire MBTA commuter rail system is equipped with modern rolling stock. The oldest coaches currently in service were delivered in 1987.

Between 1974 and 1993, inbound weekday ridership on the present Framingham Line grew from 630 passengers a day on three trains to 3,700 on 15 trains, or a

factor of 5.9. The two stations most heavily used by passengers originating west of Framingham are Framingham and West Natick. West Natick Station opened in 1982, to help relieve capacity constraints at other stations. In 1993, combined ridership at Framingham and West Natick was 1,720 per day, or a growth factor of 13.7 compared to the 125 boardings at Framingham Station alone in 1974. At all other Framingham Line stations combined, ridership in the same time span grew by a factor of 3.9.

Approximately one third of all riders boarding Framingham Line trains at Framingham or West Natick in 1993 originated at one of the communities on or tributary to the proposed Worcester extension. Total Framingham Line boardings from residents of these communities increased from 60 per day in 1975 to 589 in 1993, or a growth factor of 9.8. Nevertheless, current ridership still represents a relatively small share of the potential from this corridor.

The predominant market for MBTA commuter rail service is work trips to the Boston Central Business District. Such trips accounted for approximately 75 percent of all responses to the 1993 commuter rail survey by Framingham Line passengers. Figures from the 1990 Census indicate that there were then 1,226 work trips to the Boston CBD from the five cities and towns located directly on the Worcester extension route, and 2,159 more from other communities assumed to be in the market area of the extension, for a total of 3,385. Assuming that the share of this market captured by a commuter rail extension would represent 75 percent of the total ridership attracted to a commuter rail extension, the extension would effectively be vying for some share of 4,500 trips per day in each direction.

The Framingham Line currently captures 25 to 30 percent of Boston CBD work trips from Holliston, Ashland, Hopkinton and Westboro, but less than 15 percent from all other communities on or near the extension corridor. Given the relatively long and time-consuming access paths from most of these communities to the existing stations, more direct service could reasonably be expected to capture much higher market shares. In addition, a reduction in demand for parking at the Framingham and West Natick Stations by residents of communities west of Framingham would provide more capacity at these stations for passengers from other origins not served by the extension.

TJH/tjh

WORCESTER COMMUTER RAIL EXTENSION STUDY UPDATE

CTPS TRAVEL DEMAND FORECASTING PROCEDURES

1.0 Introduction

This appendix contains a detailed description of the travel demand forecasting procedures used to estimate the rail ridership for the proposed Worcester Commuter Rail Extension project. These procedures are very similar to those used in the 1990 Feasibility Study. In fact, in the current analysis, we used the results of a few sub-models and analysis procedures used in the original 1990 Feasibility Study.

Our travel forecasts were produced using a state-of-the-practice set of urban travel demand models. This set of models has been used at CTPS for many transit forecasting projects during the last several years.

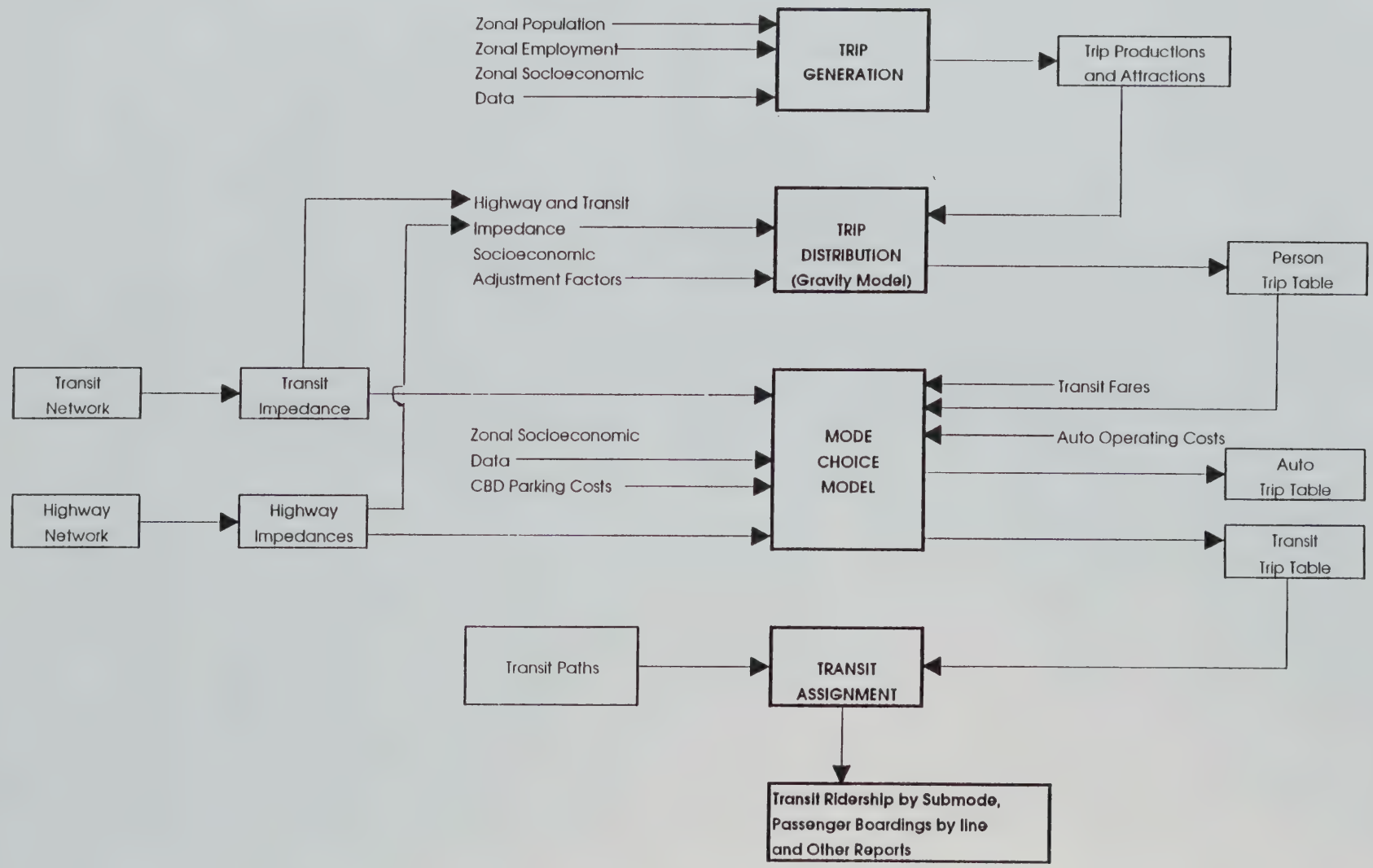
The model set simulates travel on the entire Eastern Massachusetts transit and highway system. As such, it contains all MBTA rail and bus lines and all private express bus lines. The model contains service frequency(i.e. how often trains and buses arrive at any given transit stop), routing, travel time and fares for all these lines. In the highway system, all express highways and principal arterial roadways and many minor arterial and local roadways are included.

The travel demand forecasting procedure used in this analysis is based on the traditional four-step, sequential process comprising trip generation, trip distribution, mode choice and trip assignment. This process is used to estimate average daily transit ridership, primarily on the basis of forecasts of population and employment, projected highway travel conditions (including downtown parking costs) and projected transit service to be provided. The actual structure of the travel demand forecasting process used in this study followed a somewhat simplified version of the traditional four step sequential urban transportation planning process.

The entire geographic area represented in our model, the Eastern Massachusetts, is divided into several hundred smaller areas known as **traffic zones**. Our model set employs sophisticated and involved techniques in each step of the process. The following paragraphs describe very briefly what each step does. Figure 1 shows the major inputs and outputs involved in the four step modeling process.

Trip Generation: In this step, the model estimates how many trips are generated in each traffic zone using estimates of projected population and employment and other socioeconomic characteristics of that zone.

FIGURE 1: THE FOUR STEP TRAVEL DEMAND MODELING PROCESS



Trip Distribution: In this step, the model takes the total trips generated by each zone and distributes them to all the other zones in the study area based on a Newtonian principle of relative attractiveness. This creates a trip flow pattern.

Mode Choice: After the trip flow pattern is determined, the model estimates what proportion of the trip flow is by automobile and by transit mode. It uses the relative travel times and costs by automobile and transit to estimate these proportions.

Trip Assignment: In this final step, the model assigns the transit trips to different transit modes such as Subway, Commuter Rail, Local Bus, Express Bus, etc. To do this, it uses the shortest transit path from one zone to another. This path may involve just one mode such as a local bus or multiple modes such as a local bus and a transfer to the subway line, etc. The automobile trips are assigned to the highway network and the resulting traffic volumes on all highway links are summarized.

Because the proposed rail service in this study would serve an area outside of the standard Central Transportation Planning Staff (CTPS) study region for which trip tables were already developed and available, the trip generation and distribution steps were carried out somewhat differently than for other studies in the past. This involved using information from the Central Artery/Third Harbor Tunnel Project and from a past study of commuting patterns in the greater Boston area. Existing CTPS highway networks were expanded to include the Worcester area. This network development was accomplished in the MINUTP microcomputer modelling system, as was the production of highway travel times and distances (skims) from these networks. The highway times and distances were transferred to the mainframe computer for use with the existing CTPS model set which includes the mode choice model and the assignment process.

Section 2 discusses the establishment of the market area for the proposed transit service. The method used to develop current and future year travel demand between this market area and the Boston CBD employment center is described in detail in section 3. Section 4 contains the details of the transit and highway networks used in the Worcester analysis, while sections 5 and 6 cover the development of inputs to the mode choice model and details of the mode choice model itself. Finally, section 7 describes the assignment step of the modelling procedure.

2.0 Defining the Worcester Market Area

This section describes what the market area for riders on the proposed rail service to Worcester is and how it was defined. As a part of this description, there is a brief discussion of the current market conditions, how they came about and how they are expected to evolve in the future.

2.1 Factors Defining a Market Area for New Rail Service

Several factors help determine the extent of the market area for a new commuter rail service. The majority of commuter rail trips are work trips. It follows that in defining a market area for proposed new commuter rail service, it is important to look first at how accessible the area currently is to the employment centers to which it will be connected by the new rail service. In the case of the proposed Worcester rail extension, those employment centers are Boston CBD and to a lesser extent Cambridge. The level of accessibility is usually related to how strongly oriented the market area is to Boston, and the strength of that orientation is another important factor in determining the size of the market. It is also necessary to consider existing transit services. Their locations may highlight areas which may be "underserved" by transit and provide boundaries for the potential market area for new service. The market size is also a function of the locations of proposed rail stations and the ease of access to those stations from surrounding communities.

2.2 Defining the Worcester Market Area

The Boston CBD is an important employment center for residents of the I-90/I-495 area and Central Massachusetts. Trends in housing costs and labor availability during the 1980s have strengthened what in 1980 was already a strong economic relationship between Boston and this region. Continuation of these trends into the future combined with worsening auto commute travel times into Boston suggest that the market for rail service from Central Massachusetts and the I-90/I-495 region to Boston can be expected to grow.

The Worcester corridor is well connected by highway facilities to Boston. The Massachusetts Turnpike is the most important of these. Also very important are Route 9 and to a lesser extent Route 20. Interstate 495 serves as a feeder to these east-west routes from communities such as Marlborough and Hopkinton.

Boston employment rose by approximately 50,000 between 1980 and 1987. Given its accessibility to Boston, it is not surprising that during the 1980s the number of people living in the I-90/I-495 area and Central Massachusetts and working in Boston has increased significantly. Another factor leading to this increase is that of housing costs. In the 1980 s, the Boston area real estate market experienced dramatic increases in housing costs and the rental market had extremely low vacancy rates. The average housing unit cost in Boston itself rose from $63,000 in 1980 to $178,000 in 1988, or 182%. In a suburb such as Needham, the increase was from $84,000 to $235,000, or 180%. In Worcester, the average housing unit cost went from $37,000 in 1980 to $117,000 in 1988, a 216% increase; many other communities at considerable distance from Boston experienced similar changes ("The Demographics of Commuting in Greater Boston", a CTPS Report as a portion of the Transportation Plan for the Boston MPO Region, October, 1989) . As employment in Downtown Boston expanded, a significant number of new employees were forced to live further away where more affordable housing was

available and to commute from longer distances to work than in 1980. Because the cities and towns in the I-90/I-495 area and Central Massachusetts are well connected via highways to Boston, they experienced significant growth in the number of residents working in Downtown Boston. The "push" factors of good highway connections and lower housing costs were accentuated by the fact that while employment growth was booming in the Boston area, employment growth in most of Central Massachusetts was relatively slow and unemployment rates were higher. In some labor market sectors, the labor pool in the immediate Boston area was exhausted and employers had to draw from further away. Central Massachusetts and the I-90/I-495 region, with their accessibility to Boston, availability of affordable housing and labor supply, grew significantly as a source of Downtown Boston employees during the 1980s.

Current projections of employment growth in downtown Boston along with continued lower unemployment rates and higher housing costs in comparison to the Central Massachusettsand I-90/I-495 region suggest that more people will be working downtown but commuting from further away. Meanwhile current traffic conditions on Route 9 and the Massachusetts Turnpike are rapidly becoming more congested. Projected traffic conditions show that auto commuting times to downtown Boston will be significantly longer than at present by the year 2011. This suggests that the towns and cities in the market area for the proposed rail service will constitute a significantly larger potential Downtown Boston-oriented rail market by the year 2011 than they do now.

2.3 Market Area Boundaries and Communities

In addition to the degree of Boston orientation and general accessibility, another important factor which helps to geographically define the market area for new Worcester rail service is that of existing transit service and service assumed to exist in the horizon year for the project, 2011. The current Fitchburg Line, with station stops in Littleton, Acton and Concord, defines the northern edge of the market area. The Franklin Line, with its extension to Bellingham and Milford, defines the southern edge of the market area. The eastern boundary is defined by the service to Boston which exists from Framingham. Surveys of rail service in the Boston area have shown that people are willing to travel a limited distance to reach a rail station. This information combined with 1980 and 1990 Journey-to-Work information, which shows that there were few work trips to Boston from communities further west than Spencer, helped to determine the western boundary of the market area.

The market area is perhaps most obviously determined by the locations of the proposed rail stations. Surveys of existing commuter rail service have shown that the market for a station is usually largest in the town where the station is located. While this may be partially attributed to the fact that rail stations are often located in the larger population centers of a given market area, it is also true that people are usually only willing to travel a few miles (with some exceptions, particularly line terminus stations) to reach a rail station. The following communities have rail stations located within them in the proposed rail service.

Framingham
Ashland
Southborough
Westborough
Grafton
Millbury
Worcester

In addition to these communities are the cities and towns from which potential riders can easily reach the rail stations. The following communities are within reasonable reach of the above cities and towns and are more accessible to the proposed stations than they are to any stations assumed to exist on other rail lines in 2011:

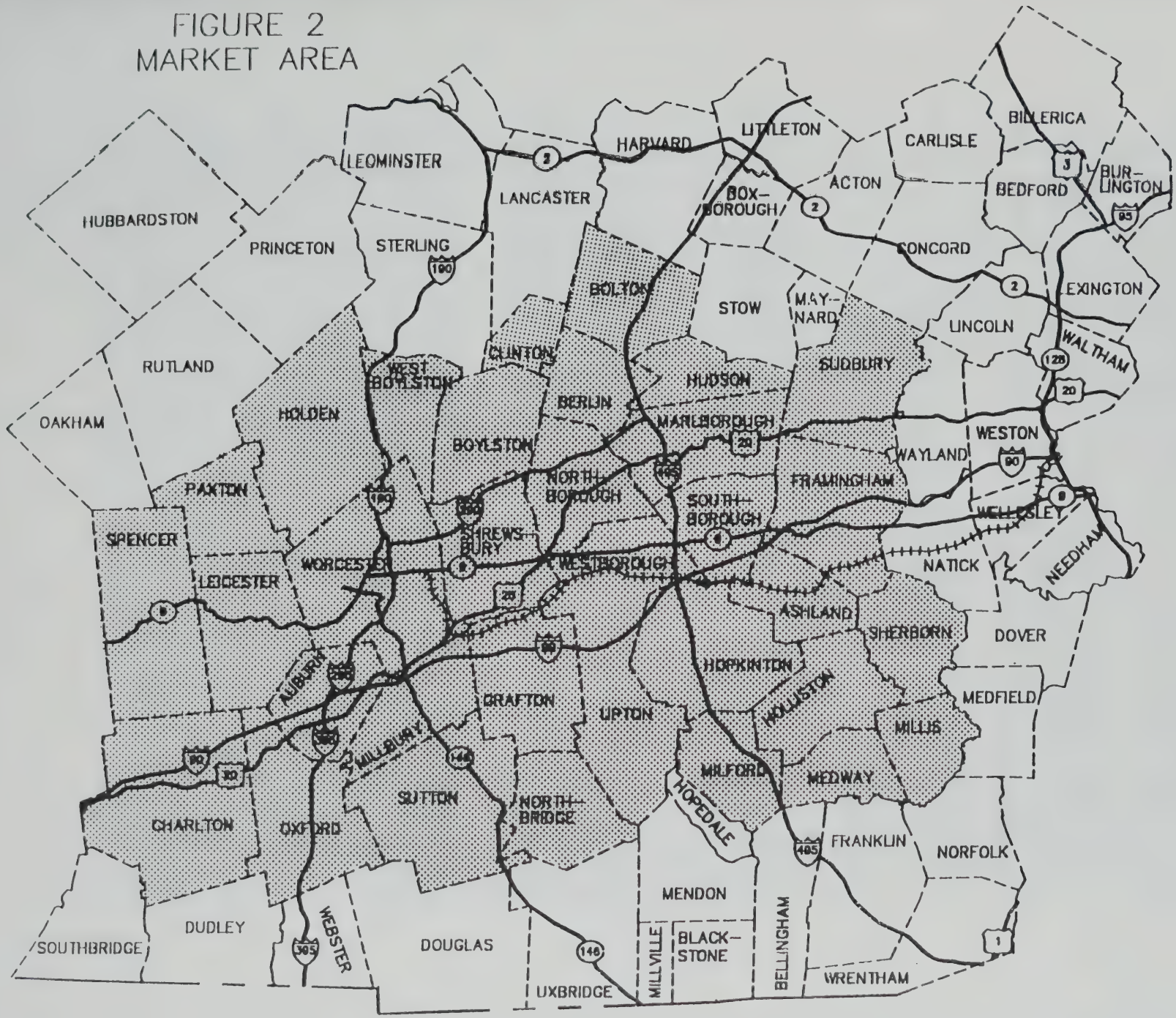
Holliston
Hopkinton
Marlborough
Milford
Upton
Hudson
Berlin
Bolton
Clinton
Northborough
Shrewsbury
Sutton
Boylston
Northbridge
Oxford
Charlton
Auburn
Holden
Paxton
Spencer
Leister
West Boylston

These communities are shown in Figure 2

2.4 Market Area Work Trips to Boston

Once the market area is defined geographically, it must be defined in terms of potential users of the proposed rail service. Recent surveys of Boston area rail lines have shown that approximately 90% of commuter rail trips are work trips and a large portion of these

FIGURE 2
MARKET AREA



are to jobs in Boston. While there are many people who both live and work within the market area, it is unlikely that a significant proportion of them would be served by radial, Boston-oriented rail service. There probably are some people who, for example, live in Worcester and work in Framingham and could conceivably use the train to travel to and from work. However, few of them would likely be willing to drive or take a bus to the Worcester station, wait for the train, ride it to Framingham, then wait for a bus or other transportation to their places of employment when they can drive from home to work in what is probably less total time. People who work in the market area can also, in most cases, park at work without much added cost or time. Traffic congestion between cities and towns in the market area is reasonable compared to congestion approaching Boston, and parking is much cheaper and more readily available than in Boston.

For these reasons the modeling procedure used to forecast rail ridership in this study was concerned primarily with work trips from the market area to Boston.

3.0 Estimation of Total Person Trips (Market Analysis)

Once the geographical market area for the proposed new rail service to Worcester was defined, it was necessary to produce a 2011 trip table. This trip table contained work trips from this market area to the Boston CBD and East Cambridge. Next to Boston CBD, east Cambridge is the biggest employer in the metropolitan Boston area and therefore was included as a destination area for the demand analysis.

As explained above, the market for the new rail service is composed primarily of work trips to the CBD as opposed to non-work trips or work trips contained entirely within the defined market area. The process of producing the work trip table incorporated the trip generation and trip distribution steps of the modelling process. As opposed to generating and distributing trips with models, however, it relied on existing trip information and socioeconomic data.

The majority of the Worcester Commuter Rail Extension study area is outside of the normal CTPS regional study area, and as a result the existing CTPS regional person trip tables developed as part of recent transit planning studies could not be used for this analysis. Consequently, the existing and year 2011 work trips from all of the cities and towns in the study corridor to the downtown Boston and Cambridge area were developed based on 1990 Census Journey-to-Work data, socioeconomic information for the cities and towns, and work trip attraction control totals for the downtown Boston area which were developed as part of the Central Artery/Third Harbor Tunnel (CA/THT) Project. The first step in this process was the tabulation of 1990 Census Journey-to-Work trips destined to Boston and Cambridge via private motorized vehicle and public transportation for each of the cities and towns in the study area. These work trips to Boston and Cambridge were then factored to 2011 based on percentage change in population for each city and town between 1990 and 2011. These percentages were taken directly from the original 1990 Feasibility Study. A factor of 0.90 was then applied to these work trips to

convert them to typical weekday estimates, accounting for employee vacation and sick time. The resulting work trips were further factored up to account for non-work related trips destined to Boston CBD and Cambridge. This factoring was done on the basis of information obtained from the 1990 Census data for each town and city within the study corridor and also from the system-wide 1993 CTPS commuter rail survey. Figure 3 shows the process used in developing the 2011 person trip table.

The final 1990 work trips and the estimated 2011 work trips from each city and town in the Worcester Commuter Rail Extension study area are presented in Table 1A.

4.0 Network Building

Network building is one of the most involved and time consuming steps in the travel demand forecasting process. The procedure entails translating written descriptions of transportation services into computer processable code. The resulting networks are used, in conjunction with trip tables, to simulate travel in the travel assignment process described later. In addition, they are used to generate matrices of data for use in the mode choice stage, also described later. Two sets of highway and transit networks were built for this study. One set represented 1988 and was used in validating the model set, while the other represented 2011 and was used to produce the transit patronage forecasts.

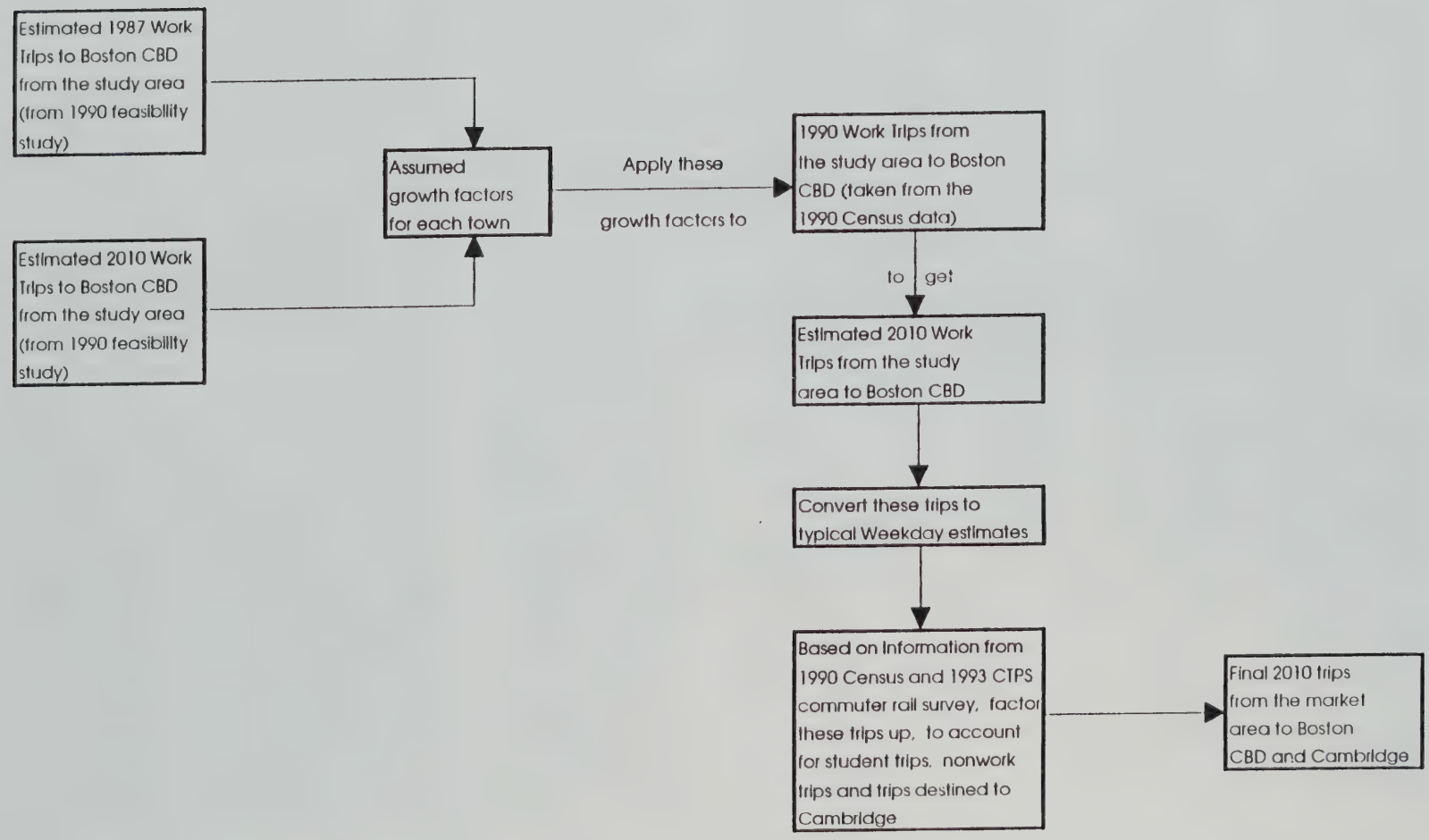
4.1 Transit Networks

Transit networks for this study were built with the UTPS INET program by adding the services of interest to an existing regional transit network developed at CTPS for use in several recent MBTA studies. The service of interest is, of course, the commuter rail extension from Framingham to Worcester. The rail line is composed of a series of links, connecting stations or stops, each link having time, distance and travel speed coded on it. Travel times for rail lines were obtained from the consultant team.

Of critical importance was the way in which access to the lines of interest was coded. These access connections largely control the level of boardings simulated at stations. Each station or stop, if in a populated area, was connected to the traffic zone system by a walk access link coded at 2.5 miles-per-hour. In addition, each was connected to one or more zones by drive access links coded with speeds representing actual automobile travel speeds in those particular areas. In general, drive access links were provided only to zones within six miles of a station, consistent with findings on travel behavior gleaned from recent transit passenger surveys.

In addition to the services of interest in this study, other "background" services - those assumed to exist in the future -were coded into the 2011 transit network. These include shuttle bus services between downtown Boston and the South Boston Piers area, North and South Station transportation centers, a Bowdoin-Charles connector, and extended rail

FIGURE 3: Development of 2010 Person Trip Table



service to Newburyport. These services have little or no effect on the line extension analyzed in this study, but were included for consistency with other studies.

4.2 Highway Networks

Present and future highway networks were built for this study in the microcomputer-based MINUTP travel analysis package. Such networks were necessary in order to generate future year estimates of auto travel times. These, as noted, were used in the mode choice model and to estimate future year rail ridership.

The existing CTPS regional highway network served as the basis for that used in this study. However, since it did not extend far enough west, a new network was developed for the study area itself. This network was coded into MINUTP and combined with the CTPS regional network, resulting in one continuous highway network from the Worcester study area to downtown Boston. The 2011 network includes the Central Artery/Third Harbor Tunnel.

5.0 Path Building and Skimming

5.1 Transit

This refers to the process of using the computer to find the most sensible -- usually defined as the quickest -- travel path between one place and another using the networks built as described above. The computer programs that build the transit paths, account for each component of the time required to make a trip by transit between every pair of zones. These components include time spent walking or driving to the transit line, waiting for the transit vehicle, riding on the line, transferring to another line, if necessary, and walking to a final destination.

Once the paths are built, the times and distances on them are skimmed by the computer, or summarized, in the form of matrices. These matrices are then saved for use in the mode choice model. The paths themselves are saved to use in the travel assignment process, described later. This process is applied both to the transit and highway networks. The procedures followed here are part of the standard urban travel demand forecasting method recognized by FTA.

5.2 Highway

Highway paths were built and skimmed solely to obtain matrices of highway travel times and distances for use in the mode choice model. The times were calculated to reflect the effects of traffic congestion. In order to do so, a highway vehicle trip table is usually required. However, as none was available for the study area itself, a different approach was used.

Traffic counts were obtained from the Central Massachusetts Regional Planning Commission and entered into the 1988 MINUTP-based highway network that was built as described above. Since counts did not exist for all the links in the network, they were estimated by imputing values from actual counts on nearby links. The MINUTP highway pathbuilding program, then, used these counts, in place of the usual assigned volumes produced from a trip table to derive minimum time paths on the study area portion of the network. In the CTPS regional highway portion of the network to the east, congested times and minimum time paths were based, in the usual manner, on a 1988 vehicle trip table assignment. The path skimming program was then applied to the paths connecting the study area with downtown Boston to produce matrices of distance and congested time which were then transferred to the mainframe computer for use in the mode choice model.

This process was followed in order to validate, or ensure the accuracy, of the 1988-based model set. After validation, the traffic counts in the study area were factored up to 2011 based on historical growth rates and changes in area population and employment. Within the CTPS regional highway network, an existing 2011 regional vehicle trip table was assigned and the pathbuilder and pathskimmer applied in order to yield complete study area-to-Boston highway skims. These were transferred to the mainframe computer for use in the 2011 mode choice analysis.

6.0 Mode Choice Analysis

Mode choice is the third step in the four-step travel demand forecasting process, after trip generation and trip distribution, and before assignment. The first two steps, as described earlier, were accomplished within the trip table development process. The mode choice analysis for the Worcester Commuter Rail Extension Feasibility Study was accomplished in the traditional FTA-recommended manner using a regionally calibrated binary choice model that accounts for all major determinants of travel choice.

The CTPS mode choice model was used to allocate person trips to the two primary competing modes -- auto and transit. This allocation is based on the desirability or utility of each choice a traveller faces, which in turn, is based on the attributes of that choice and the characteristics of the individual. The transit person trips resulting from the model were assigned to the transit network to yield estimates of boardings.

The model requires several pieces of information as inputs. Derivation of transit and highway skims, the most important inputs, was described earlier. In addition, the model also requires CBD parking costs, automobile operating costs, transit fares, zonal socioeconomic data such as automobiles per capita, etc. The 2011 transit fares for the proposed commuter rail line were made consistent with those on existing rail lines that extend as far from Boston as this would. The proposed rail stations were categorized by fare zone as follows:

Station	Fare Zone
Framingham	5
Ashland	6
Westborough	7
Grafton	9
Millbury	10
Worcester	10

7.0 Transit Trip Assignment

Assignment of transit trips (output from the mode choice model) to the transit network is the last step in the traditional four-step travel demand forecasting process. The process allocates transit trips to individual routes in the network, and yields printouts of boardings by station and line. The transit paths, described earlier, are input to the assignment process. The accuracy of the passenger boardings produced by the assignment process depends on the size of the zones used in the analysis. In general, the finer the zone system, the more accurate is the transit assignment. In this study, the zone size in the study area was made identical to the city and town boundary because the 1990 Journey-to-Work Census data were available only at that level. From past experience, we knew that the transit assignments resulting from a coarse zone system would be very lumpy and difficult to interpret. Therefore, we followed different approach in which we allocated the transit trips to the proposed rail stations manually using a procedure described below.

The estimated 2011 transit trips from each city and town in the study area to Boston CBD and Cambridge are shown in Table 2. These trips were allocated to each station on the proposed commuter rail extension manually. First, each town or city was subdivided into four quadrants based on highway network and general accessibilty. Then the total transit trips originating from each town were distributed to its four quadrants based on the density of their residential development. The transit trips from each quadrant were allocated to a nearby station which minimized the total cost and travel time for the passenger. In most cases, the station choice for different quadrants within a city or a town within the study area was clear. For those quadrants which had multiple station choice, we further subdivided the trips and allocated them to nearby stations using the procedure described above.

The parking demand at each new station was estimated by first subtracting the walk trips from the total transit trips and then by applying an auto occupancy rate to convert the remaining auto access trips to equivalent parking spaces. In this analysis, parking turnover was not taken into account. It would not be desirable to size a parking facility in such a way that the last driver takes the last parking space: the capacity of a parking facility should be greater than its demand to provide good service, as a roadway is designed to provide a "B" or "C" level of service rather than "E". The capacity of a parking facility should be greater than its demand for the purpose also of accomodating fluctuation of demand because the estimated demand represents the value on an average day of the year.

8.0 Model Results

Using the modeling procedure described above, we analyzed three different scenarios as per the MBTA's request. The results of the demand analysis are summarized in Table 1.

Scenario 1

In scenario 1, six stations in the following communities were assumed on the rail extension.

A new station at Pleasant Street in Ashland
A new station at Route 85 in Southborough
A new station at Otis Street in Westborough
A new station at Tufts Veterinary School in Grafton
A new station at Mass. Turnpike Exit 11 in Millbury
A new station in downtown Worcester

Scenario 2

In Scenario 2, we included a Regional Station in addition to those in Scenario 1. This Regional Station would be located near the I-90/I-495 interchange in Westborough.

Scenario 3

In this scenario, we analyzed Worcester plus each station listed in Scenario 2 individually.

We assumed that the demand at all stations would be unconstrained by parking capacity with the exception of a special case where the capacity at Southborough station would be constrained to a maximum of 420 spaces.

The results of the assignment process were summarized into a trip matrix showing the total number of daily inbound commuter rail trips from each community to each station in the study area. Tables 3 through 10 summarize the demand forecasts for the first scenario for the years 1996, 2001, 2006 and 2011. Initially, we developed the demand forecasts for the year 2011 using the modeling process. The forecasts for the years 1996, 2001 and 2006 were developed from the 2011 numbers using an interpolation technique.

As can be seen from these tables, Ashland station would have the highest demand for parking spaces, about 760 spaces in 2011. We assumed that most of the existing Southborough and Ashland riders who currently use the Framingham station would now switch to the proposed Southborough and Ashland stations. This would free up some parking constraints at the existing Framingham station. It is likely that these excess spaces may be filled by the residents of Framingham and Holliston. A more thorough analysis of latent demand at Framingham station is necessary to verify this conclusion.

If the parking capacity at Southborough station is constrained to 420 spaces, then the demand at Ashland Station would be even higher, nearly 880 spaces in 2011. The parking demand at Worcester station would be around 350 in 2011.

Tables 11 through 14 summarize the parking demand forecasts for the second scenario. The Regional station, because of its excellent access from I-90 and I-495, would draw ridership from Southborough, Hopkinton, Marlborough, Milford, Upton, Hudson, Berlin, Bolton, Clinton and Westborough. We project a parking demand of about 450 spaces at this station in the year 2011. As one would expect, with a Regional station in place, the demand at Ashland, Southborough and Westborough would be lower than in the first scenario.

In the third scenario, we analyzed the combined effect of a station in Worcester and a local station in any one community along the alignment. Our analysis results indicate that a station in Worcester and a station in Ashland would generate the highest demand of nearly 1,670 spaces in 2011 (see Table 39). The station combination that would have the second highest demand would be Worcester and a Regional station located near Interstate 495 and Mass Pike. The results of the third scenario are shown in Table 15 through 38 and Table 39 summarizes these results.

Highway Impacts

As can be seen from all the tables presented in this Appendix, the passenger demand on the proposed extension may range from 950 to 2900 inbound riders per day depending on how many intermediate stations are assumed to be in place. The maximum demand would be for the second scenario where six intermediate stations including a regional station are assumed. In all the scenarios, the projected commuter rail demand would be coming from two different sources: 1. those who use the existing bus service and 2. those who would be driving to downtown in an automobile. Since majority of the projected rail demand would be coming from the automobile mode, we can expect to see some traffic reduction on those facilities serving the study area and the Boston downtown. We performed a highway assignment to analyze the traffic impact primarily on Route 9 and Massachusetts TurnPike.

For the first scenario, we estimate about 2,700 inbound person trips using the proposed commuter rail extension in the year 2011. About 85% of these trips would be coming from the automobile mode and the remaining from the private bus carriers. The diversion of auto trips to commuter rail would cause some traffic reduction on both Route 9 and the Massachusetts Turnpike. Since the access to the turnpike within the study area is limited to only exits 11, 11A and 12 , the magnitude of traffic reduction on these two facilities would vary between these exits. The results of our traffic assignment process indicates that Route 9 would enjoy a traffic reduction of about 400 vehicles during the morning peak period in the year 2011 between Worcester and I-495. An additional reduction of nearly 1,140 vehicles can be expected between I-495 and Route 128. Massachusetts

Turnpike on the other hand, would be carrying about 920 less vehicles between I-495 and Route 128 during the morning peak period. To the east of Route 128, most of the traffic reduction would take place on the turnpike. As can be seen from Table 40, nearly 1,770 vehicles may be taken off the turnpike to the east of Route 128 during the A.M. Peak period. Similar reductions can be expected during the P.M. peak period.

Our models estimate the transit demand based on comparitive travel times and total travel costs associated with the transit and automobile modes. They do not account for such variables as convenience, comfort, perceived ease of access and perceived safety. In our analysis, we have implicitly assumed that all the proposed stations will have good access from the highway network and that the parking lots will be safe and well lit. We also assumed that in general, commuters do not wish to make long reverse trips by auto to catch an inbound train. The demand estimates we have presented in this as well as our previous memorandums are our best estimates under the above-mentioned assumptions.

Table 1 Summary of Estimated Demand for Parking Spaces for Each Station

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Proposed supply (with regional station)	700	420	1000	300	250	300	500	3,470
Proposed supply (without regional station)	700	420	0	300	250	300	500	2,470
Scenario 1 (constrained at Southboro only)								
1996 demand	570	470		180	90	120	290	1,720
2001 demand	630	510		190	100	130	300	1,860
2006 demand	690	550		200	110	150	330	2,030
2011 demand	760	600		220	120	160	350	2,210
Scenario 1 (constrained at Southboro only)								
1996 demand	590	420		180	90	120	290	1,690
2001 demand	670	420		190	100	130	300	1,810
2006 demand	770	420		200	110	150	330	1,980
2011 demand	880	420		220	120	160	350	2,150
Scenario 2								
1996 demand	520	310	370	140	90	120	290	1,840
2001 demand	570	340	390	150	100	130	300	1,980
2006 demand	630	370	420	160	110	150	330	2,170
2011 demand	690	410	450	170	120	160	350	2,350
Scenario 3								
1996 demand								
Worcester & Millbury						280	320	600
Worcester & Grafton					370		330	700
Worcester & Westboro				420			430	850
Worcester & Regional			860				410	1,270
Worcester & Southboro		520					470	990
Worcester & Ashland	840						450	1,290
2001 demand								
Worcester & Millbury						310	340	650
Worcester & Grafton					390		350	740
Worcester & Westboro				440			460	900
Worcester & Regional			920				440	1,360
Worcester & Southboro		560					500	1,060
Worcester & Ashland	920						480	1,400
2006 demand								
Worcester & Millbury						340	360	700
Worcester & Grafton					430		380	810
Worcester & Westboro				470			500	970
Worcester & Regional			990				480	1,470
Worcester & Southboro		610					550	1,160
Worcester & Ashland	1010						520	1,530
2011 demand								
Worcester & Millbury						370	390	760
Worcester & Grafton					460		410	870
Worcester & Westboro				500			530	1,030
Worcester & Regional			1060				520	1,580
Worcester & Southboro		660					590	1,250
Worcester & Ashland	1110						560	1,670

Table 1 Summary of Estimated Demand for Parking Spaces for Each Station

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Proposed supply (with regional station)	700	420	1000	300	250	300	500	3,470
Proposed supply (without regional station)	700	420	0	300	250	300	500	2,470
Scenario 1 (constrained at Southboro only)								
1996 demand	570	470		180	90	120	290	1,720
2001 demand	630	510		190	100	130	300	1,860
2006 demand	690	550		200	110	150	330	2,030
2011 demand	760	600		220	120	160	350	2,210
Scenario 1 (constrained at Southboro only)								
1996 demand	590	420		180	90	120	290	1,690
2001 demand	670	420		190	100	130	300	1,810
2006 demand	770	420		200	110	150	330	1,980
2011 demand	880	420		220	120	160	350	2,150
Scenario 2								
1996 demand	520	310	370	140	90	120	290	1,840
2001 demand	570	340	390	150	100	130	300	1,980
2006 demand	630	370	420	160	110	150	330	2,170
2011 demand	690	410	450	170	120	160	350	2,350
Scenario 3								
1996 demand								
Worcester & Millbury						280	320	600
Worcester & Grafton					370		330	700
Worcester & Westboro				420			430	850
Worcester & Regional			860				410	1,270
Worcester & Southboro		520					470	990
Worcester & Ashland	840						450	1,290
2001 demand								
Worcester & Millbury						310	340	650
Worcester & Grafton					390		350	740
Worcester & Westboro				440			460	900
Worcester & Regional			920				440	1,360
Worcester & Southboro		560					500	1,060
Worcester & Ashland	920						480	1,400
2006 demand								
Worcester & Millbury						340	360	700
Worcester & Grafton					430		380	810
Worcester & Westboro				470			500	970
Worcester & Regional			990				480	1,470
Worcester & Southboro		610					550	1,160
Worcester & Ashland	1010						520	1,530
2011 demand								
Worcester & Millbury						370	390	760
Worcester & Grafton					460		410	870
Worcester & Westboro				500			530	1,030
Worcester & Regional			1060				520	1,580
Worcester & Southboro		660					590	1,250
Worcester & Ashland	1110						560	1,670

TABLE 1A: 1990 CENSUS WORKTRIPS AND 2011 ESTIMATED TOTAL TRIPS

TOWN	1990 Census Worktrips to Boston CBD	Estimated 2011 Total Trips to Boston CBD and East Cambridge
Holliston	356	560
AshLand	482	881
Southboro	161	288
Hopkinton	179	283
Marlboro	360	611
Milford	434	654
Upton	128	183
Hudson	113	182
Berlin	9	12
Bolton	37	60
Clinton	78	125
Westboro	117	160
Northboro	121	183
Shrewsbury	132	222
Grafton	46	82
Sutton	0	24
Boylston	0	24
Northbridge	32	51
Oxford	27	46
Charlton	0	24
Millbury	42	60
Auburn	47	135
Worcester	378	535
Holden	62	100
Paxton	8	13
Spencer	6	11
Leicester	5	8
West Boylston	25	40
TOTAL	3,385	5,557

TABLE 2: ESTIMATED 2011 TRANSIT TRIPS

(From Study Area to Boston CBD and East Cambridge)

TOWN	2011 Transit Trips to Boston CBD and East Cambridge
Holliston	344
Ashland	523
Southboro	156
Hopkinton	174
Marlboro	314
Milford	72
Upton	138
Hudson	49
Berlin	5
Bolton	20
Clinton	42
Westboro	92
Northboro	109
Shrewsbury	107
Grafton	50
Sutton	20
Boylston	20
Northbridge	35
Oxford	23
Charlton	20
Millbury	30
Auburn	85
Worcester	355
Holden	67
Paxton	13
Spencer	5
Leicester	5
West Boylston	40
TOTAL	2,913

Table 3 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2011 (Without a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	344						344
Ashland	523						523
Southboro	27	129					156
Hopkinton	52	122					174
Marlboro		314					314
Upton		92	46				138
Westboro		67	25				92
Northboro			109				109
Shrewsbury			83	24			107
Grafton				50			50
Sutton				20			20
Boylston				20			20
Northbridge				35			35
Oxford					23		23
Charlton					20		20
Millbury					30		30
Auburn					51	34	85
Worcester					71	284	355
Holden						67	67
Paxton						13	13
Spencer						5	5
Leicester						5	5
W.Boylston						40	40
Total	946	725	263	149	195	448	2,725
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	76	58	21	12	16	36	218
Park'n'Ride	850	667	242	137	179	392	2,467
Parking Spaces							
Demand	760	600	220	120	160	350	2,210
Supply	700	420	300	250	300	500	2,470

Table 4

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2011 (Without a Regional Station, Demand Unconstrained by Parking Capacity Except at Southborough Station)

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	344						344
Ashland	523						523
Southboro	53	99					152
Hopkinton	76	94					170
Marlboro	65	238					303
Upton	18	71	46				135
Westboro	14	51	25				90
Northboro			109				109
Shrewsbury			83	24			107
Grafton				50			50
Sutton				20			20
Boylston				20			20
Northbridge				35			35
Oxford					23		23
Charlton					20		20
Millbury					30		30
Auburn					51	34	85
Worcester					71	284	355
Holden						67	67
Paxton						13	13
Spencer						5	5
Leicester						5	5
W.Boylston						40	40
Total	**1,093**	**553**	**263**	**149**	**195**	**448**	**2,701**
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	87	83	21	12	16	36	255
Park'n'Ride	986	470	242	137	179	392	2,406
Parking Spaces							
Demand	**880**	**420**	**220**	**120**	**160**	**350**	**2,150**
Supply	700	420	300	250	300	500	2,470

Table 5 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2006 (Without a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	320						320
Ashland	471						471
Southboro	24	117					140
Hopkinton	49	113					162
Mariboro		286					286
Upton		88	43				131
Westboro		64	24				88
Northboro			102				102
Shrewsbury			77	22			98
Grafton				45			45
Sutton				18			18
Boylston				19			19
Northbridge				32			32
Oxford					21		21
Charlton					19		19
Millbury					29		29
Auburn					41	27	68
Worcester					68	273	341
Holden						62	62
Paxton						12	12
Spencer						5	5
Leicester						5	5
W.Boylston						37	37
Total	863	668	246	136	177	421	2,512
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	69	53	20	11	14	34	201
Park'n'Ride	774	614	227	125	163	367	2,271
Parking Spaces							
Demand	690	550	200	110	150	330	2,030
Supply	700	420	300	250	300	500	2,470

Table 6 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2006 (Without a Regional Station, Demand Unconstrained by Parking Capacity Except at Southborough Station)

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	320						320
Ashland	471						471
Southboro	41	97					138
Hopkinton	65	90					155
Marlboro	43	235					278
Upton	12	74	43				129
Westboro	10	54	24				88
Northboro			102				102
Shrewsbury			77	22			98
Grafton				45			45
Sutton				18			18
Boylston				19			19
Northbridge				32			32
Oxford					21		21
Charlton					19		19
Millbury					29		29
Auburn					41	27	68
Worcester					68	273	341
Holden						62	62
Paxton						12	12
Spencer						5	5
Leicester						5	5
W.Boylston						37	37
Total	**962**	**550**	**246**	**136**	**177**	**421**	**2,492**
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	77	83	20	11	14	34	238
Park'n'Ride	865	468	227	125	163	367	2,214
Parking Spaces							
Demand	**770**	**420**	**200**	**110**	**150**	**330**	1,980
Supply	700	420	300	250	300	500	2,470

Table 7 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001 (Without a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	299						299
Ashland	418						418
Southboro	21	105					126
Hopkinton	45	105					150
Marlboro		261					261
Upton		84	41				126
Westboro		62	23				86
Northboro			96				96
Shrewsbury			70	20			90
Grafton				41			41
Sutton				17			17
Boylston				18			18
Northbridge				30			30
Oxford					19		19
Charlton					18		18
Millbury					27		27
Auburn					33	22	54
Worcester					65	258	323
Holden						58	58
Paxton						11	11
Spencer						4	4
Leicester						4	4
W.Boylston						34	34
Total	784	617	231	125	162	392	2,310
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	63	49	18	10	13	31	185
Park'n'Ride	701	567	212	115	149	341	2,085
Parking Spaces							
Demand	630	510	190	100	130	300	1,860
Supply	700	420	300	250	300	500	2,470

Table 8

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001 (Without a Regional Station, Demand Unconstrained by Parking Capacity Except at Southborough Station)

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	299						299
Ashland	418						418
Southboro	31	94					125
Hopkinton	53	95					148
Marlboro	25	232					257
Upton	7	76	41				124
Westboro	4	56	23				83
Northboro			96				96
Shrewsbury			70	20			90
Grafton				41			41
Sutton				17			17
Boylston				18			18
Northbridge				30			30
Oxford					19		19
Charlton					18		18
Millbury					27		27
Auburn					33	22	54
Worcester					65	258	323
Holden						58	58
Paxton						11	11
Spencer						4	4
Leicester						4	4
W.Boylston						34	34
Total	838	553	230	125	162	392	2,299
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	67	83	18	10	13	31	223
Park'n'Ride	751	470	212	115	149	341	2,036
Parking Spaces							
Demand	670	420	190	100	130	300	1,810
Supply	700	420	300	250	300	500	2,470

Table 9 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 1996 (Without a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	279						279
Ashland	377						377
Southboro	19	95					114
Hopkinton	42	97					139
Marlboro		239					239
Upton		80	40				120
Westboro		60	22				83
Northboro			90				90
Shrewsbury			64	18			82
Grafton				37			37
Sutton				16			16
Boylston				17			17
Northbridge				28			28
Oxford					17		17
Charlton					17		17
Millbury					26		26
Auburn					27	18	44
Worcester					62	247	309
Holden						54	54
Paxton						10	10
Spencer						4	4
Leicester						4	4
W.Boylston						32	32
Total	**716**	**571**	**217**	**115**	**149**	**369**	**2,137**
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	57	46	17	9	12	29	171
Park'n'Ride	639	526	199	106	137	319	1,926
Parking Spaces							
Demand	**570**	**470**	**180**	**90**	**120**	**290**	1,720
Supply	700	420	300	250	300	500	2,470

Table 10 **Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 1996 (Without a Regional Station, Demand Unconstrained by Parking Capacity Except at Southborough Station)**

	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin							
Holliston	279						279
Ashland	377						377
Southboro	24	90					114
Hopkinton	47	92					139
Marlboro	11	228					239
Upton		80	40				120
Westboro		60	22				83
Northboro			90				90
Shrewsbury			64	18			82
Grafton				37			37
Sutton				16			16
Boylston				17			17
Northbridge				28			28
Oxford					17		17
Charlton					17		17
Millbury					26		26
Auburn					27	18	44
Worcester					62	247	309
Holden						54	54
Paxton						10	10
Spencer						4	4
Leicester						4	4
W.Boylston						32	32
Total	**737**	**551**	**217**	**115**	**149**	**369**	**2,137**
Person Trips by Mode of Access							
Walk	20	0	0	0	0	20	40
Kiss'n'Ride	59	83	17	9	12	29	210
Park'n'Ride	658	468	199	106	137	319	1,887
Parking Spaces							
Demand	**590**	**420**	**180**	**90**	**120**	**290**	**1,690**
Supply	700	420	300	250	300	500	**2,470**

Table 11 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2011 (With a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	344							344
Ashland	523							523
Southboro		117	39					156
Hopkinton		136	38					174
Marlboro		245	69					314
Milford			72					72
Upton			138					138
Hudson			49					49
Berlin			5					5
Bolton			20					20
Clinton			42					42
Westboro			74	18				92
Northboro				109				109
Shrewsbury				83	24			107
Grafton					50			50
Sutton					20			20
Boylston					20			20
Northbridge					35			35
Oxford						23		23
Charlton						20		20
Millbury						30		30
Auburn						51	34	85
Worcester						71	284	355
Holden							67	67
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							40	40
Total	**867**	**498**	**546**	**211**	**149**	**195**	**448**	**2,913**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	40
Kiss'n'Ride	69	40	44	17	12	16	36	233
Park'n'Ride	778	458	502	194	137	179	392	2,640
Parking Spaces								
Demand	**690**	**410**	**450**	**170**	**120**	**160**	**350**	**2,350**
Supply	700	420	1000	300	250	300	500	3,470

Table 12 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2006
(With a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	320							320
Ashland	471							471
Southboro		105	35					140
Hopkinton		126	36					162
Marlboro		223	63					286
Milford			68					68
Upton			131					131
Hudson			46					46
Berlin			5					5
Bolton			18					18
Clinton			39					39
Westboro			71	18				88
Northboro				102				102
Shrewsbury				77	22			98
Grafton					45			45
Sutton					18			18
Boylston					19			19
Northbridge					32			32
Oxford						21		21
Charlton						19		19
Millbury						29		29
Auburn						41	27	68
Worcester						68	273	341
Holden							62	62
Paxton							12	12
Spencer							5	5
Leicester							5	5
W.Boylston							37	37
Total	**791**	**454**	**510**	**197**	**136**	**177**	**421**	**2,687**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	**40**
Kiss'n'Ride	63	36	41	16	11	14	34	**215**
Park'n'Ride	707	418	470	181	125	163	367	**2,432**
Parking Spaces								
Demand	**630**	**370**	**420**	**160**	**110**	**150**	**330**	**2,170**
Supply	700	420	1000	300	250	300	500	**3,470**

Table 13 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001
(With a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	299							299
Ashland	418							418
Southboro		95	32					126
Hopkinton		117	33					150
Marlboro		203	57					261
Milford			64					64
Upton			126					126
Hudson			42					42
Berlin			5					5
Bolton			17					17
Clinton			36					36
Westboro			68	17				86
Northboro				96				96
Shrewsbury				70	20			90
Grafton					41			41
Sutton					17			17
Boylston					18			18
Northbridge					30			30
Oxford						19		19
Charlton						18		18
Millbury						27		27
Auburn						33	22	54
Worcester						65	258	323
Holden							58	58
Paxton							11	11
Spencer							4	4
Leicester							4	4
W.Boylston							34	34
Total	**718**	**415**	**479**	**183**	**125**	**162**	**392**	**2,473**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	40
Kiss'n'Ride	57	33	38	15	10	13	31	198
Park'n'Ride	640	382	441	168	115	149	341	2,236
Parking Spaces								
Demand	**570**	**340**	**390**	**150**	**100**	**130**	**300**	**1,980**
Supply	700	420	1000	300	250	300	500	**3,470**

Table 14 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 1996
(With a Regional Station, Demand Unconstrained by Parking Capacity)

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	279							279
Ashland	377							377
Southboro		85	28					114
Hopkinton		109	31					139
Marlboro		186	53					239
Milford			60					60
Upton			120					120
Hudson			39					39
Berlin			4					4
Bolton			16					16
Clinton			33					33
Westboro			66	17				83
Northboro				90				90
Shrewsbury				64	18			82
Grafton					37			37
Sutton					16			16
Boylston					17			17
Northbridge					28			28
Oxford						17		17
Charlton						17		17
Millbury						26		26
Auburn						27	18	44
Worcester						62	247	309
Holden							54	54
Paxton							10	10
Spencer							4	4
Leicester							4	4
W.Boylston							32	32
Total	**655**	**380**	**451**	**171**	**115**	**149**	**369**	**2,290**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	40
Kiss'n'Ride	52	30	36	14	9	12	29	183
Park'n'Ride	583	350	415	158	106	137	319	2,067
Parking Spaces								
Demand	**520**	**310**	**370**	**140**	**90**	**120**	**290**	**1,840**
Supply	700	420	1000	300	250	300	500	3,470

Table 15

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
(With a Station in Worcester and one in Millbury)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro								
Northboro								
Shrewsbury						107		107
Grafton						50		50
Sutton						20		20
Boylston						20		20
Northbridge						35		35
Oxford						25		25
Charlton						25		25
Millbury						35		35
Auburn						56	38	94
Worcester						78	312	390
Holden							73	73
Paxton							15	15
Spencer							5	5
Leicester							5	5
W.Boylston							45	45
Total	**0**	**0**	**0**	**0**	**0**	**451**	**493**	**944**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	0	0	36	39	76
Park'n'Ride	0	0	0	0	0	415	433	848
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**0**	**370**	**390**	**760**
Supply	0	0	0	0	0	300	500	800

Table 16

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2011
(With a Station in Worcester and one in Grafton)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton					35			35
Hudson								
Berlin								
Bolton								
Clinton								
Westboro					20			20
Northboro					75			75
Shrewsbury					116			116
Grafton					55			55
Sutton					22			22
Boylston					22			22
Northbridge					38			38
Oxford					26			26
Charlton					22			22
Millbury					33			33
Auburn					43		43	85
Worcester					59		332	390
Holden							73	73
Paxton							15	15
Spencer							5	5
Leicester							5	5
W.Boylston							45	45
Total	**0**	**0**	**0**	**0**	**565**	**0**	**517**	**1,082**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	0	45	0	41	87
Park'n'Ride	0	0	0	0	520	0	456	975
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**460**	**0**	**410**	**870**
Supply	0	0	0	0	250	0	500	750

Table 17

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
(With a Station in Worcester and one in Westborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton				145				145
Hudson								
Berlin				6				6
Bolton								
Clinton								
Westboro				100				100
Northboro				115				115
Shrewsbury				106			12	118
Grafton				53				53
Sutton				23				23
Boylston				23				23
Northbridge				35				35
Oxford							20	20
Charlton							18	18
Millbury				5			20	25
Auburn							78	78
Worcester							385	385
Holden							72	72
Paxton							14	14
Spencer							5	5
Leicester							5	5
W.Boylston							43	43
Total	**0**	**0**	**0**	**611**	**0**	**0**	**672**	**1,283**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	49	0	0	54	103
Park'n'Ride	0	0	0	562	0	0	598	1,160
Parking Spaces								
Demand	**0**	**0**	**0**	**500**	**0**	**0**	**530**	**1,030**
Supply	0	0	0	300	0	0	500	800

Table 18 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2011

(Worcester Station and a Regional Station) No Parking Constraints

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro			125					125
Hopkinton			150					150
Marlboro			300					300
Milford			75					75
Upton			145					145
Hudson			50					50
Berlin			10					10
Bolton			25					25
Clinton			45					45
Westboro			92					92
Northboro			102					102
Shrewsbury			81				14	95
Grafton			40					40
Sutton			15					15
Boylston			10				10	20
Northbridge			25					25
Oxford							20	20
Charlton							20	20
Millbury							25	25
Auburn							85	85
Worcester							315	315
Holden							75	75
Paxton							20	20
Spencer							10	10
Leicester							10	10
W.Boylston							45	45
Total	**0**	**0**	**1,290**	**0**	**0**	**0**	**649**	**1,939**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	103	0	0	0	52	155
Park'n'Ride	0	0	1187	0	0	0	577	1,764
Parking Spaces								
Demand	**0**	**0**	**1060**	**0**	**0**	**0**	**520**	**1,580**
Supply	0	0	1000	0	0	0	500	1,500

Table 19

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2011
(With a Station in Worcester and one in Southborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro		160						160
Hopkinton		145						145
Marlboro		252						252
Milford		36						36
Upton		30						30
Hudson								
Berlin								
Bolton								
Clinton								
Westboro		92						92
Northboro		65						65
Shrewsbury							53	53
Grafton		25						25
Sutton								20
Boylston							18	18
Northbridge								35
Oxford							20	20
Charlton							18	18
Millbury							27	27
Auburn							90	90
Worcester							376	376
Holden							71	71
Paxton							14	14
Spencer							5	5
Leicester							5	5
W.Boylston							42	42
Total	**0**	**805**	**0**	**0**	**0**	**0**	**739**	**1,599**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	64	0	0	0	0	59	124
Park'n'Ride	0	741	0	0	0	0	660	1,400
Parking Spaces								
Demand	**0**	**660**	**0**	**0**	**0**	**0**	**590**	**1,250**
Supply	0	420	0	0	0	0	500	920

Table 20

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2011
(With a Station in Worcester and one in Ashland)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	344							344
Ashland	523							523
Southboro	111							111
Hopkinton	122							122
Marlboro	240							240
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro	27							27
Northboro								
Shrewsbury							32	32
Grafton								
Sutton								
Boylston								
Northbridge								
Oxford							18	18
Charlton							16	16
Millbury							24	24
Auburn							92	92
Worcester							383	383
Holden							72	72
Paxton							14	14
Spencer							5	5
Leicester							5	5
W.Boylston							43	43
Total	**1,367**	**0**	**0**	**0**	**0**	**0**	**704**	**2,071**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	40
Kiss'n'Ride	109	0	0	0	0	0	56	166
Park'n'Ride	1238	0	0	0	0	0	628	1,865
Parking Spaces								
Demand	**1110**	**0**	**0**	**0**	**0**	**0**	**560**	**1,670**
Supply	700	0	0	0	0	0	500	1,200

TABLE 21

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
(With a Station in Worcester and one in Millbury)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro								
Northboro								
Shrewsbury						98		98
Grafton						45		45
Sutton						18		18
Boylston						19		19
Northbridge						32		32
Oxford						23		23
Charlton						24		24
Millbury						34		34
Auburn						45	30	75
Worcester						75	300	374
Holden							68	68
Paxton							14	14
Spencer							5	5
Leicester							5	5
W.Boylston							42	42
Total	**0**	**0**	**0**	**0**	**0**	**413**	**463**	**875**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	0	0	33	37	70
Park'n'Ride	0	0	0	0	0	380	406	785
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**0**	**340**	**360**	**700**
Supply	0	0	0	0	0	300	500	800

Table 22

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
(With a Station in Worcester and one in Grafton)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton					33			33
Hudson								
Berlin								
Bolton								
Clinton								
Westboro					19			19
Northboro					71			71
Shrewsbury					107			107
Grafton					50			50
Sutton					20			20
Boylston					21			21
Northbridge					35			35
Oxford					24			24
Charlton					21			21
Millbury					32			32
Auburn					34		34	68
Worcester					56		318	374
Holden							68	68
Paxton							14	14
Spencer							5	5
Leicester							5	5
W.Boylston							42	42
Total	**0**	**0**	**0**	**0**	**521**	**0**	**485**	**1,006**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	0	42	0	39	81
Park'n'Ride	0	0	0	0	480	0	426	906
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**430**	**0**	**380**	**810**
Supply	0	0	0	0	250	0	500	750

Table 23

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
(With a Station in Worcester and one in Westborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton				138				138
Hudson								
Berlin				6				6
Bolton								
Clinton								
Westboro				96				96
Northboro				108				108
Shrewsbury				98			11	109
Grafton				48				48
Sutton				21				21
Boylston				22				22
Northbridge				32				32
Oxford							18	18
Charlton							17	17
Millbury				5			19	24
Auburn							62	62
Worcester							370	370
Holden							67	67
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							40	40
Total	**0**	**0**	**0**	**573**	**0**	**0**	**626**	**1,199**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	46	0	0	50	96
Park'n'Ride	0	0	0	527	0	0	556	1,083
Parking Spaces								
Demand	**0**	**0**	**0**	**470**	**0**	**0**	**500**	**970**
Supply	0	0	0	300	0	0	500	**800**

Table 24

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2006

(Worcester Station and a Regional Station) No Parking Constraints

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro			113					113
Hopkinton			140					140
Marlboro			273					273
Milford			71					71
Upton			138					138
Hudson			47					47
Berlin			10					10
Bolton			23					23
Clinton			41					41
Westboro			88					88
Northboro			102					96
Shrewsbury			74				13	87
Grafton			36					36
Sutton			14					14
Boylston			9				9	19
Northbridge			23					23
Oxford							18	18
Charlton							19	19
Millbury							24	24
Auburn							68	68
Worcester							302	302
Holden							70	70
Paxton							19	19
Spencer							9	9
Leicester							9	9
W.Boylston							42	42
Total	**0**	**0**	**1,201**	**0**	**0**	**0**	**603**	**1,797**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	96	0	0	0	48	144
Park'n'Ride	0	0	1105	0	0	0	534	1,639
Parking Spaces								
Demand	**0**	**0**	**990**	**0**	**0**	**0**	**480**	**1,470**
Supply	0	0	1000	0	0	0	500	1,500

Table 25

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
(With a Station in Worcester and one in Southborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro		144						144
Hopkinton		135						135
Marlboro		229						229
Milford		34						34
Upton		29						29
Hudson								
Berlin								
Bolton								
Clinton								
Westboro		88						88
Northboro		61						61
Shrewsbury							49	49
Grafton		23						23
Sutton								18
Boylston							17	17
Northbridge								32
Oxford							18	18
Charlton							17	17
Millbury							26	26
Auburn							72	72
Worcester							361	361
Holden							66	66
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							39	39
Total	**0**	**742**	**0**	**0**	**0**	**0**	**687**	**1,480**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	59	0	0	0	0	55	114
Park'n'Ride	0	683	0	0	0	0	612	1,295
Parking Spaces								
Demand	**0**	**610**	**0**	**0**	**0**	**0**	**550**	**1,160**
Supply	0	420	0	0	0	0	500	**920**

Table 26

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2006
(With a Station in Worcester and one in Ashland)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	320							320
Ashland	471							471
Southboro	100							100
Hopkinton	113							113
Marlboro	218							218
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro	26							26
Northboro								
Shrewsbury							29	29
Grafton								
Sutton								
Boylston								
Northbridge								
Oxford							16	16
Charlton							15	15
Millbury							23	23
Auburn							74	74
Worcester							368	368
Holden							67	67
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							40	40
Total	**1,248**	**0**	**0**	**0**	**0**	**0**	**654**	**1,903**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	40
Kiss'n'Ride	100	0	0	0	0	0	52	152
Park'n'Ride	1128	0	0	0	0	0	582	1,711
Parking Spaces								
Demand	**1010**	**0**	**0**	**0**	**0**	**0**	**520**	**1,530**
Supply	700	0	0	0	0	0	500	1,200

Table 27

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
(With a Station in Worcester and one in Millbury)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro								
Northboro								
Shrewsbury						90		90
Grafton						41		41
Sutton						17		17
Boylston						18		18
Northbridge						30		30
Oxford						21		21
Charlton						22		22
Millbury						32		32
Auburn						36	24	60
Worcester						71	284	355
Holden							63	63
Paxton							13	13
Spencer							4	4
Leicester							4	4
W.Boylston							39	39
Total	**0**	**0**	**0**	**0**	**0**	**377**	**431**	**808**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	0	0	30	34	65
Park'n'Ride	0	0	0	0	0	347	377	723
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**0**	**310**	**340**	**650**
Supply	0	0	0	0	0	300	500	800

Table 28

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001
(With a Station in Worcester and one in Grafton)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton					32			32
Hudson								
Berlin								
Bolton								
Clinton								
Westboro					19			19
Northboro					66			66
Shrewsbury					97			97
Grafton					45			45
Sutton					18			18
Boylston					20			20
Northbridge					32			32
Oxford					22			22
Charlton					20			20
Millbury					30			30
Auburn					27		27	54
Worcester					53		302	355
Holden							63	63
Paxton							13	13
Spencer							4	4
Leicester							4	4
W.Boylston							39	39
Total	**0**	**0**	**0**	**0**	**481**	**0**	**452**	**933**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	**20**
Kiss'n'Ride	0	0	0	0	38	0	36	**75**
Park'n'Ride	0	0	0	0	442	0	396	**838**
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**390**	**0**	**350**	**740**
Supply	0	0	0	0	250	0	500	**750**

Table 29

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001
(With a Station in Worcester and one in Westborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton				132				132
Hudson								
Berlin				6				6
Bolton								
Clinton								
Westboro				93				93
Northboro				101				101
Shrewsbury				89			10	99
Grafton				43				43
Sutton				19				19
Boylston				20				20
Northbridge				30				30
Oxford							17	17
Charlton							16	16
Millbury				5			18	23
Auburn							50	50
Worcester							350	350
Holden							62	62
Paxton							12	12
Spencer							4	4
Leicester							4	4
W.Boylston							37	37
Total	**0**	**0**	**0**	**538**	**0**	**0**	**581**	**1,119**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	43	0	0	46	90
Park'n'Ride	0	0	0	495	0	0	514	1,009
Parking Spaces								
Demand	**0**	**0**	**0**	**440**	**0**	**0**	**460**	**900**
Supply	0	0	0	300	0	0	500	**800**

Table 30 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001

(Worcester Station and a Regional Station) No Parking Constraints

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro			101					101
Hopkinton			129					129
Marlboro			249					249
Milford			67					67
Upton			132					132
Hudson			43					43
Berlin			9					9
Bolton			21					21
Clinton			38					38
Westboro			86					86
Northboro			102					90
Shrewsbury			68				12	80
Grafton			32					32
Sutton			13					13
Boylston			9				9	18
Northbridge			21					21
Oxford							17	17
Charlton							18	18
Millbury							23	23
Auburn							54	54
Worcester							287	287
Holden							65	65
Paxton							17	17
Spencer							8	8
Leicester							9	9
W.Boylston							39	39
Total	0	0	1,120	0	0	0	557	1,665
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	90	0	0	0	45	134
Park'n'Ride	0	0	1031	0	0	0	492	1,523
Parking Spaces								
Demand	0	0	920	0	0	0	440	1,360
Supply	0	0	1000	0	0	0	500	1,500

Table 31 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001
(With a Station in Worcester and one in Southborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro		130						130
Hopkinton		125						125
Marlboro		209						209
Milford		32						32
Upton		27						27
Hudson								
Berlin								
Bolton								
Clinton								
Westboro		86						86
Northboro		57						57
Shrewsbury							45	45
Grafton		20						20
Sutton								17
Boylston							16	16
Northbridge								30
Oxford							17	17
Charlton							16	16
Millbury							25	25
Auburn							58	58
Worcester							342	342
Holden							61	61
Paxton							12	12
Spencer							4	4
Leicester							4	4
W.Boylston							36	36
Total	**0**	**686**	**0**	**0**	**0**	**0**	**636**	**1,368**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	55	0	0	0	0	51	106
Park'n'Ride	0	631	0	0	0	0	565	1,196
Parking Spaces								
Demand	**0**	**560**	**0**	**0**	**0**	**0**	**500**	**1,060**
Supply	0	420	0	0	0	0	500	920

Table 32

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 2001
(With a Station in Worcester and one in Ashland)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	299							299
Ashland	418							418
Southboro	90							90
Hopkinton	105							105
Marlboro	199							199
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro	25							25
Northboro								
Shrewsbury							27	27
Grafton								
Sutton								
Boylston								
Northbridge								
Oxford							15	15
Charlton							14	14
Millbury							22	22
Auburn							59	59
Worcester							349	349
Holden							62	62
Paxton							12	12
Spencer							4	4
Leicester							4	4
W.Boylston							37	37
Total	**1,137**	**0**	**0**	**0**	**0**	**0**	**605**	**1,742**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	40
Kiss'n'Ride	91	0	0	0	0	0	48	139
Park'n'Ride	1026	0	0	0	0	0	537	1,563
Parking Spaces								
Demand	**920**	**0**	**0**	**0**	**0**	**0**	**480**	**1,400**
Supply	700	0	0	0	0	0	500	1,200

Table 33

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
(With a Station in Worcester and one in Millbury)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro								
Northboro								
Shrewsbury						82		82
Grafton						37		37
Sutton						16		16
Boylston						17		17
Northbridge						28		28
Oxford						19		19
Charlton						21		21
Millbury						30		30
Auburn						29	20	49
Worcester						68	271	339
Holden							58	58
Paxton							12	12
Spencer							4	4
Leicester							4	4
W.Boylston							36	36
Total	**0**	**0**	**0**	**0**	**0**	**347**	**405**	**752**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	0	0	28	32	60
Park'n'Ride	0	0	0	0	0	319	353	672
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**0**	**280**	**320**	**600**
Supply	0	0	0	0	0	300	500	800

Table 34

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
(With a Station in Worcester and one in Grafton)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton					30			30
Hudson								
Berlin								
Bolton								
Clinton								
Westboro					18			18
Northboro					62			62
Shrewsbury					89			89
Grafton					40			40
Sutton					17			17
Boylston					18			18
Northbridge					30			30
Oxford					20			20
Charlton					18			18
Millbury					29			29
Auburn					22		22	44
Worcester					51		288	339
Holden							58	58
Paxton							12	12
Spencer							4	4
Leicester							4	4
W.Boylston							36	36
Total	**0**	**0**	**0**	**0**	**446**	**0**	**425**	**871**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	0	36	0	34	70
Park'n'Ride	0	0	0	0	410	0	371	781
Parking Spaces								
Demand	**0**	**0**	**0**	**0**	**370**	**0**	**330**	**700**
Supply	0	0	0	0	250	0	500	750

Table 35

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
(With a Station in Worcester and one in Westborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro								
Hopkinton								
Marlboro								
Milford								
Upton				126				126
Hudson								
Berlin				5				5
Bolton								
Clinton								
Westboro				90				90
Northboro				95				95
Shrewsbury				82			9	91
Grafton				39				39
Sutton				18				18
Boylston				19				19
Northbridge				28				28
Oxford							15	15
Charlton							15	15
Millbury				4			17	22
Auburn							41	41
Worcester							335	335
Holden							58	58
Paxton							11	11
Spencer							4	4
Leicester							4	4
W.Boylston							34	34
Total	**0**	**0**	**0**	**507**	**0**	**0**	**543**	**1,050**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	0	41	0	0	43	84
Park'n'Ride	0	0	0	466	0	0	480	946
Parking Spaces								
Demand	**0**	**0**	**0**	**420**	**0**	**0**	**430**	**850**
Supply	0	0	0	300	0	0	500	800

Table 36 Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 1996

(Worcester Station and a Regional Station) No Parking Constraints

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro			91					91
Hopkinton			120					120
Marlboro			228					228
Milford			63					63
Upton			126					126
Hudson			40					40
Berlin			9					9
Bolton			20					20
Clinton			36					36
Westboro			83					83
Northboro			102					85
Shrewsbury			62				11	73
Grafton			29					29
Sutton			12					12
Boylston			8				8	17
Northbridge			20					20
Oxford							15	15
Charlton							17	17
Millbury							22	22
Auburn							44	44
Worcester							274	274
Holden							60	60
Paxton							16	16
Spencer							8	8
Leicester							8	8
W.Boylston							36	36
Total	**0**	**0**	**1,049**	**0**	**0**	**0**	**519**	**1,551**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	0	84	0	0	0	42	125
Park'n'Ride	0	0	965	0	0	0	458	1,423
Parking Spaces								
Demand	**0**	**0**	**860**	**0**	**0**	**0**	**410**	**1,270**
Supply	0	0	1000	0	0	0	500	1,500

Table 37

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
(With a Station in Worcester and one in Southborough)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston								
Ashland								
Southboro		117						117
Hopkinton		116						116
Marlboro		192						192
Milford		30						30
Upton		26						26
Hudson								
Berlin								
Bolton								
Clinton								
Westboro		83						83
Northboro		54						54
Shrewsbury							41	41
Grafton		18						18
Sutton								16
Boylston							15	15
Northbridge								28
Oxford							15	15
Charlton							15	15
Millbury							23	23
Auburn							47	47
Worcester							327	327
Holden							57	57
Paxton							11	11
Spencer							4	4
Leicester							4	4
W.Boylston							34	34
Total	**0**	**636**	**0**	**0**	**0**	**0**	**593**	**1,272**
Person Trips by Mode of Access								
Walk	0	0	0	0	0	0	20	20
Kiss'n'Ride	0	51	0	0	0	0	47	98
Park'n'Ride	0	585	0	0	0	0	526	1,111
Parking Spaces								
Demand	**0**	**520**	**0**	**0**	**0**	**0**	**470**	990
Supply	0	420	0	0	0	0	500	920

Table 38

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 1996
(With a Station in Worcester and one in Ashland)
Unconstrained Parking

	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Holliston	279							279
Ashland	377							377
Southboro	81							81
Hopkinton	98							98
Marlboro	182							182
Milford								
Upton								
Hudson								
Berlin								
Bolton								
Clinton								
Westboro	24							24
Northboro								
Shrewsbury							25	25
Grafton								
Sutton								
Boylston								
Northbridge								
Oxford							14	14
Charlton							13	13
Millbury							21	21
Auburn							48	48
Worcester							333	333
Holden							58	58
Paxton							11	11
Spencer							4	4
Leicester							4	4
W.Boylston							34	34
Total	**1,041**	**0**	**0**	**0**	**0**	**0**	**565**	**1,605**
Person Trips by Mode of Access								
Walk	20	0	0	0	0	0	20	40
Kiss'n'Ride	83	0	0	0	0	0	45	128
Park'n'Ride	937	0	0	0	0	0	500	1,437
Parking Spaces								
Demand	**840**	**0**	**0**	**0**	**0**	**0**	**450**	**1,290**
Supply	700	0	0	0	0	0	500	1,200

TABLE 39
WORCESTER COMMUTER RAIL EXTENSION PROJECT

SUMMARY OF PARKING DEMAND FORECASTS, Year 2010

	Worcester	Intermediate Station	Total Demand
Worcester&Millbury	390	370	**760**
Worcester&Grafton	410	460	**870**
Worcester&Westboro	530	500	**1,030**
Worcester&Regional	520	1,060	**1,580**
Worcester&Southboro	590	660	**1,250**
Worcester&Ashland	560	1,110	**1,670**

Table 40

Worcester Commuter Rail Extension Study, Highway Impacts

Scenario: All six stations, No Regional Station, Unconstrained Parking Except at Southborough

Projected reductions in Traffic Volumes During Morning Peak Period

Year	Reduction in Traffic volumes during the morning peak period					
	Between Worcester and I-495		Between I-495 and Rte 128		Between Rte 128 and downtown Boston	
	Mass Pike	**Rte 9**	**Mass Pike**	**Rte 9**	**MassPike**	**Rte 9**
1996	125	335	555	980	1,400	130
2001	130	350	620	1,020	1,510	135
2006	135	380	700	1,080	1,640	140
2011	140	400	780	1,140	1,770	150

SECTION 3.0

NOISE AND VIBRATION

WORCESTER COMMUTER RAIL EXTENSION PROJECT

Framingham to Worcester, Massachusetts

APPENDIX 3.0 - NOISE AND VIBRATION

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WORCESTER COMMUTER RAIL EXTENSION PROJECT

Framingham to Worcester, MA

APPENDIX 3.0 - NOISE AND VIBRATION

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1. MEASURES OF NOISE AND VIBRATION

1.1 Noise Descriptors

The most commonly used measure of noise is the A-weighted sound level, expressed in decibels (dBA). The A-weighted sound level is a single-number measure of sound pressure level with weighted frequency characteristics that correspond to human subjective response to noise. It is universally accepted by acousticians as a proper unit for describing environmental noise.

An understanding of the following is helpful in providing a subjective impression of changes in the A-weighted sound level:

- Except in carefully controlled laboratory experiments, an increase of only 1 dBA in sound level cannot be perceived;
- Outside the laboratory, a 3 dBA increase in sound level is considered a barely noticeable difference;
- A change in sound level of at least 5 dBA is required before any significant change in a community would be perceived;
- A 10 dBA increase in sound level is subjectively heard as approximately a doubling in loudness.

Following is a list of noise metrics and their definitions, all based on A-weighted sound level and commonly used in analyses of community noise.

Maximum Level, L_{max}: As a train approaches, passes by and then recedes into the distance, the A-weighted sound level at a fixed wayside location rises, reaches a maximum, and then fades into the backgroun noise. The maximum sound level reached during this pass-by is called the Maximum Level, abbreviated L_{max}.

L_{max} is commonly used in vehicle noise specifications and is often measured to characterize the noise from individual vehicles. However, L_{max} is not normally used as the descriptor for train noise impact assessment for several reasons. L_{max} ignores the number and duration of train events, which are important to people's reaction to noise, and cannot be summed into

a time-cumulative measure of impact, such as over a 24-hour period. Moreover, L_{max} is not conducive to comparison among different transportation modes or equipment types. The cumulative descriptors used for such assessments are discussed below.

Sound Exposure Level, SEL: The quantitative measure of the noise does for single noise events is the Sound Exposure Level, or SEL. The fact that SEL is a cumulative measure means that (1) louder events have higher SELs than do quieter ones, and (2) events that last longer in time have higher SELs than do shorter ones generating the same L_{max}. People react to the duration of noise events, judging longer events to be more annoying than shorter ones.

Quantitatively SEL can be considered equivalent to the total sound energy of an event normalized or "squeezed" into a one-second time duration. Hence, unlike L_{max}, SEL increases with the duration of a noise event and also allows for a uniform assessment method for different types of transit modes and/or vehicle types. Also, SEL can be mathematically totalled to obtain the one-hour and 24-hour cumulative descriptors defined below.

Equivalent Sound Level, L_{eq}: Because environmental noise fluctuates from moment to moment, it is common practice to condense all this information into a single number, called the "equivalent" or "energy average" sound level, or L_{eq}. Because many surveys show that L_{eq} properly predicts annoyance, this descriptor is commonly used for noise impact assessment. L_{eq} can be thought of as the steady sound level that represents the same sound energy as the varying sound levels over a specified time period.

Commonly used equivalent noise descriptors are the $L_{eq}(h)$, measured over a one-hour period, and the $L_{eq}(24)$, measured over a 24-hour period. The L_{eq} during the noisiest hour of the day (peak-hour L_{eq}), is used as the official noise metric for the Federal Highway Administration (FHWA) in noise abatement studies.

Day-Night Sound Level, L_{dn}: One of the most widely accepted measures of cumulative noise exposure in residential areas is the Day-Night Sound Level, abbreviated L_{dn}. The L_{dn} is the A-weighted equivalent sound level over a 24-hour period with an additional 10-decibel weighting imposed on noise that occurs during the nighttime hours (between 10:00 pm and 7:00 am).

Except for extreme situations, L_{dn} is generally found to range between 55 dBA and 75 dBA

in populated areas. L_{dn} has been formally adopted by most public agencies dealing with noise exposure, including the Federal Aviation Administration (FAA), the Department of Defense, and the Department of Housing and Urban Development (HUD).

Exceedance Level, L_n: Environmental noise can also be viewed on a statistical basis using percentile sound exceedance levels, L_n, which refer to the sound level exceeded "n" percent of the time. For example, the sound level exceeded 90 percent of the time (L_{90}) is often considered to represent the "background" noise in a community. Similarly, the sound level exceeded 33 percent of the time (L_{33}) is often used to approximate the L_{eq} from traffic in the absence of sporadic events such as aircraft overflights and train passages.

1.2 Vibration Descriptors

As trains pass over railroad tracks, forces are generated between the train wheels and the rails that cause ground motion. Although the amplitude of this motion is too small to be seen, they can be felt, especially if the observer is very close to the tracks. This motion is known as ground-borne vibration. Ground-borne vibrations propagate away from the tracks as waves, in much the same manner as ripples propagate across the surface of a pond. One important aspect of ground vibration is that they diminish with distance from the tracks.

Vibration is defined as an oscillatory motion of an object about some equilibrium position which can be described in terms of displacement, velocity or acceleration. Although displacement is easier to understand than velocity or acceleration, it is rarely used for describing ground-borne vibration. One reason for this is that most vibration sensors are designed to provide output signals proportional to either velocity or acceleration. Even more important, the response of humans, buildings and equipment to vibration is more accurately described using velocity or acceleration. Because sensitivity to vibration has typically been found to correspond to a constant level of vibration velocity amplitude within the low frequency range of most concern for environmental vibration (roughly 5 to 100 Hz), vibration velocity is used in this analysis to describe ground-borne vibration from train operations.

There are several different descriptors that are used to quantify vibration amplitude. One of the most common is the peak particle velocity (PPV), defined as the maximum instantaneous positive or negative peak of the vibratory motion. PPV is often used in monitoring blasting vibration since it is related to the stresses experienced by building components. Although PPV is appropriate for evaluating the potential for building damage,

it is less suitable for evaluating human response which is better related to an average vibration amplitude. Because the net average of a vibration signal about its equilibrium position is zero, the root mean square (rms) amplitude is often used to describe the "smoothed" amplitude. The rms amplitude is defined as the average of the squared amplitude of the signal, and is typically evaluated over a one-second period of time.

Based on the above discussion, rms vibration velocity has been selected as the basic descriptor of ground-borne vibration for the present analysis. Although velocity is normally described in units of inches per second in the USA, the decibel notation, which acts to compress the range of numbers required to describe vibration magnitude, can also be used. In this notation, the vibration magnitude is expressed in terms of velocity level, in decibels, defined as follows:

$$V_{dB} = 20 \log_{10} \left(\frac{v}{v_{ref}}\right)$$

where: v = rms velocity, in./sec
v_{ref} = 1×10^{-6} in./sec

Thus, the descriptor used in this analysis for the assessment of ground-borne vibration is the rms vibration velocity level, V_{db}, expressed in decibels relative to one μinch per second.

1.3 Frequency-Related Descriptors

Both sound and vibration are described by oscillating waves at one or more specific frequencies measured in hertz (Hz). The wave motion can occur at a single frequency, such as a tuning fork or a "pure tone", or at different frequencies simultaneously. Most sound and vibration signals obtained in practice consist of many frequencies occurring simultaneously that cannot be reflected in a single number or decibel level.

The frequency components can be revealed by plotting wave amplitude (either sound or vibration level) against frequency. The breakdown of acoustic signals into individual frequency components is called *spectral analysis,* and this type of plot is known as a *frequency spectrum.* A frequency spectrum can be analyzed using different bandwidths depending on the range or resolution desired. For most environmental analysis either octave band or one-third octave band levels are sufficient. Octave band analysis is an example of a constant

percentage bandwidth spectrum, and each octave is defined as a frequency range where the maximum frequency is twice the minimum frequency. An octave band level is all of the sound or vibration energy that occurs within the minimum and maximum frequencies of a specific octave band. Each octave band is divided into three one-third octave bands.

2. NOISE AND VIBRATION IMPACT CRITERIA

This section provides a summary of the impact and mitigation criteria used in the noise and vibration assessment for the Worcester Commuter Rail Extension Project. The following standards were considered during development of the criteria:

- Both current official and unofficial Federal Transit Administration (FTA, formerly UMTA) guidelines;
- Noise policy of the Massachusetts Department of Environmental Protection (DEP);
- The criteria implemented in the Old Colony Railroad Rehabilitation Project during its environmental assessment process;
- Various other federal agency standards (FHWA, HUD, etc.).

Although an advantage of the Old Colony criteria is that they hold precedence in their prior application to an MBTA-sponsored project, it is important to keep in mind that these criteria were originally developed in 1986 before the availability of *any* federally-authorized noise and vibration criteria for railroad or mass transit projects. In the meantime, improved criteria have since been developed for FTA which were adopted for this project. The details of the proposed criteria and selection process are presented here.

2.1 Noise Impact Criteria

The significance of noise impacts were assessed using criteria that are specific to each of the following components of the Worcester Commuter Rail Extension Project: (1) train operations along the rail corridor from Framingham to Worcester, (2) train operations in the proposed layover facility, (3) grade crossing warning devices, (4) project-generated motor vehicle traffic near proposed commuter rail stations, and (5) short-term construction activities at and in the vicinity of the proposed station sites. Impact criteria for each of these

components are summarized in Table 1 and discussed below.

Table 1. Summary of Noise Impact Criteria

IMPACT CATEGORY	SOURCE OF IMPACT	MEASURE OF IMPACT	IMPACT CRITERIA
NOISE	Train noise at noise-sensitive receivers.	Projected increase in L_{dn} compared with existing conditions.	Proposed FTA Noise Impact Criteria. (see Fig. 1)
	Layover Facility and Grade Crossing warning devices (i.e. horns)	i) Projected increase in L_{dn} compared with existing conditions; ii) Pure-tone condition.	i) Proposed FTA Criteria; ii) Massachusetts DEP noise policy.
	Traffic noise near proposed stations.	Projected increase in peak hour L_{eq} compared with existing conditions.	Current FTA criteria (increase greater than 5 dBA).
	Construction noise at noise-sensitive land use.	Projected Annual Average L_{dn} from construction.	Projected Annual Average L_{dn} > 65 dBA.

2.1.1 Train Noise

Noise impacts from train operations on the rail corridor and in the new layover facility were assessed based on a comparison between the existing and projected noise levels expected after project implementation. This increase will be measured in terms of the day-night sound level, L_{dn}. This noise metric correlates well with the effects of noise on people and is the environmental noise measure recommended by the U.S. Environmental Protection Agency (EPA). L_{dn} represents the total dose of noise energy at a given outdoor location over a 24-hour period in terms of the A-weighted sound level (dBA), with an additional 10 dB weighting imposed on the equivalent sound levels occurring during the nighttime hours (10 pm to 7 am). L_{dn} is only applied for residences and other buildings where people normally sleep.

The standards by which a project-generated increase in L_{dn} is designated as significant impact vary according to the regulating agency involved as well as the current "thinking" of the time. Following is a discussion of three slightly different standards which are applicable to commuter rail, including that used for the Old Colony Project.

2.1.1.1 Old Colony Project Noise Criteria

The approach used for noise impact assessment in the Old Colony commuter rail restoration project takes into account two undesirable effects of re-establishing rail service into a community: the noise levels generated may be high enough to interfere with human activities such as speech, sleep or concentration, **or** the new source may increase the ambient noise level sufficiently to cause general annoyance. As a result, noise impact was assessed by comparing the project-generated noise levels (in the absence of any other noise sources) with an "absolute" standard and then by comparing the resultant increase in community noise with a "relative" standard.

Absolute impact for commuter rail operations is based only on the L_{dn} resulting from the A-weighted sound levels of trains passbys, according to standards assigned to land uses with varying noise sensitivities, as shown in Table 2.

The "Impact" levels shown are consistent with levels identified by other federal agencies such as HUD and FAA as the upper limit of compatibility with land uses shown. Noise from the project in this range is considered to be significant, and may qualify for mitigating measures.

The "Mitigation" noise levels are identified where the project noise is severe enough to <u>require</u> noise abatement measures. These noise levels are 10 dBA higher than those commonly used for rapid transit facilities. There are a number of reasons for the higher limits:

- Commuter rail trains usually operate every 1/2 hour during the morning and after peak periods and on an intermittent schedule during the remainder of the day. They rarely operate in the nighttime hours. Rapid transit trains operate on a much more regular schedule.

- The locomotives are often the source of the maximum sound level from a commuter rail train. In contrast, each vehicle on a rapid transit train creates similar noise levels. As a result, the maximum noise levels during the passage of a commuter train last for a shorter period of time than the maximum noise levels of a rapid transit train.

- The railroad right-of-way has been in existence for many years, with train traffic a common occurrence for the alignment.

Table 2. Old Colony Absolute Noise Criteria

LAND USE DESIGNATION	DESCRIPTION	NOISE IMPACT LEVEL, L_{dn} (dBA)	
		Impact	Mitigation
Category 1.	Buildings and parklands where quiet is an important element in their intended purpose. This category includes tracts of land set aside for serenity and quiet and such land uses as outdoor concert pavilions.	60	65
Category 2.	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.	65	70
Category 3.	Institutional land uses with primarily daytime use. This category includes schools, libraries, churches, and active parks where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Offices where quiet is important, such as medical offices and conference rooms, fall into this category. Places of worship or meditation associated with cemeteries, monuments, and historical sites are also included.	70	75

Relative noise impact is assessed by comparing the future L_{dn} with the existing L_{dn}. If the increase in existing L_{dn} caused by project sources is 5 dBA or more, then relative impact is considered to occur. In slightly different terms, the project begins to cause relative impact if its average noise level is 3 dBA or more above the existing noise level in the vicinity of the project.

Finally, the criteria used for consideration of mitigation measures on the Old Colony project included all locations for which impact was identified. For residences, consideration for noise abatement would apply to all residences within the L_{dn} = 65 dBA contour. For those residences located between the L_{dn} 65 and 70 dBA contours, the relative noise criterion was applied and considerations of feasibility and

reasonableness were made as additional requirements for noise abatement.

To summarize, the Old Colony criteria for noise mitigation are as follows, with reference to Table 2:

1. If the land use category lies between impact and mitigation levels, and:

   - there is no relative impact, then the site does not qualify for noise abatement measures;

   - there will be relative impact, but the mitigation measures do not meet cost-benefit criteria for reasonableness, then the site does not qualify for noise abatement measures;

   - there will be relative impact, and cost-benefit criteria are met, then the site qualifies for noise abatement measures.

2. If the land use category lies within the contour defining mitigation levels, then the site qualifies for and *requires* noise abatement measures. This involves either construction of a noise barrier or soundproofing of each individual building.

The cost-benefit criterion used was based upon the measure established by Massachusetts Department of Public Works (DPW, now MassHighway), prescribing an upper limit of $2400/dB/dwelling for noise barriers applied to the first floor only. Physical feasibility criteria are site-specific; that is, they are governed by such factors as track configuration, available right-of-way, and physical obstructions.

2.1.1.2 Current Federal Transit Administration Criteria

Noise impact criteria for transit projects seeking federal funding are included in UMTA Circular C 5620.1 by the U.S. Federal Transit Administration (FTA, formerly UMTA). These criteria are based solely on noise increase in terms of L_{dn}. The criteria consider noise increases of 3 dBA or less to be "generally not significant," noise increases of 4 or 5 dBA to be "possibly significant," and noise increases of more than 5 dBA to be "generally significant."

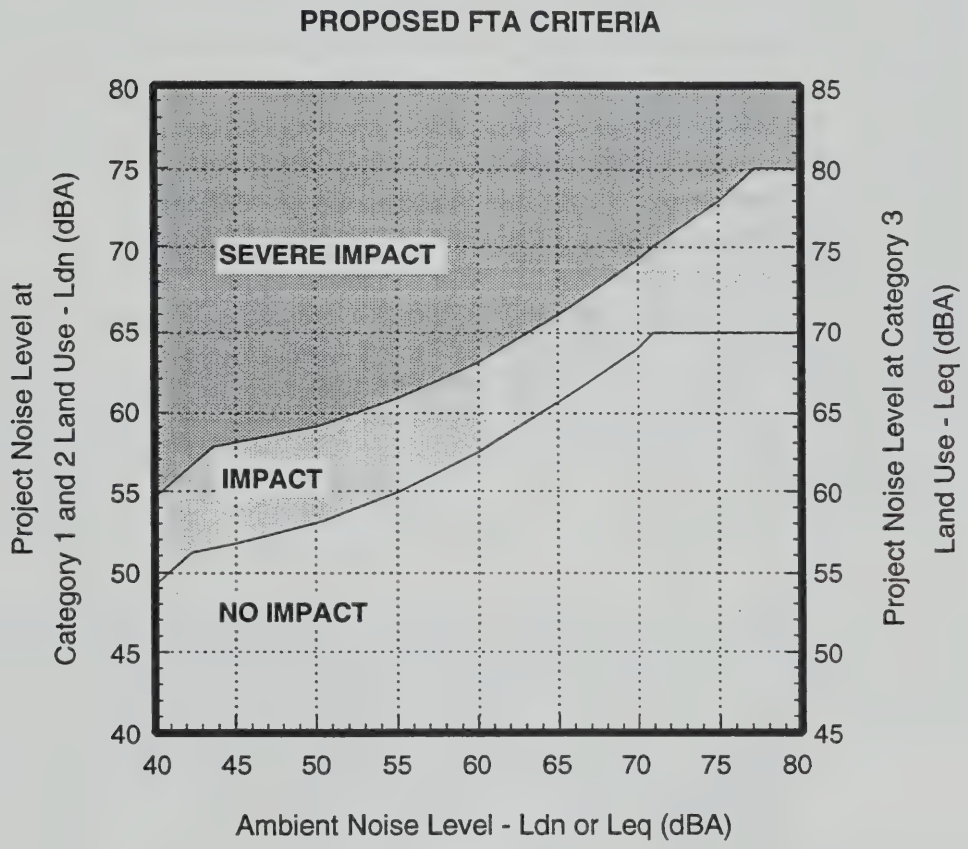
2.1.1.3 Proposed Federal Transit Administration Guidelines

Both the Old Colony and the current FTA criteria are lacking in that they do not take into account the varying sensitivity of communities to projects under different background noise conditions. FTA is

currently developing a "Guidance Manual for Transit Noise and Vibration Impact Assessment" which includes new criteria for noise and vibration impact evaluation. These criteria have been developed based on well-documented research into human response to community noise, as well as existing regulatory standards (EPA, APTA, HUD). The criteria are shown graphically in Figure 1, with the definitions of Land Use Categories 1, 2 and 3 corresponding to those described in Table 2.

The main difference between these new criteria and the two other standards described is that the criteria for both levels of impact vary according to the ambient noise and predicted project noise levels, and is determined by the threshold at which the percentage of people highly annoyed by the project noise is measurable and/or significant. In general, the criteria reflect an equivalent increase in noise annoyance depending on the existing noise level, allowing less of an increase at locations where existing noise levels are higher. Above a given upper limit of project noise, however, the impact is no longer dependent on the ambient level and is determined by project noise alone.

Below the lower curve in Figure 1, the project is considered to have no noise impact since, on the average, the introduction of the project will result in an insignificant increase in the number of people highly annoyed by the new noise. For project noise above the upper curve, FTA uses the term "Severe Impact," since a significant percentage of people would be highly annoyed by the new noise. Between the two curves, the project is judged to have an impact, though not significant. The change in the cumulative noise level is noticeable to most people, but may not be sufficient to cause adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation, such as the predicted level of increase over existing noise levels and the types and numbers of noise-sensitive land uses affected.



LAND USE CATEGORIES:

1. Tracts of Land Set Aside for Serenity and Quiet (Leq)
2. Residences and Buildings where People Normally Sleep (Ldn)
3. Institutional Land Use with Primarily Daytime or Evening Use (Leq)

Figure 1. Proposed FTA Noise Impact Criteria

2.1.1.4 Train Noise Impact Criteria for Worcester Commuter Rail Project

The proposed FTA criteria described above are yet to be officially adopted by FTA, although they have been authorized for use in a number of FTA transit projects. They are applicable to all rail projects (rapid transit, light rail, commuter rail and automated guideway transit) as well as fixed facilities such as storage and maintenance yards, passenger stations and terminals. The criteria are appropriate for different transit modes of operation, are sensitive to heightened community annoyance caused by late-night or early-morning transit service, and to communities' varying sensitivity to increased noise under different existing noise conditions. They prescribe similar conditions on project noise as the Old Colony criteria, yet were revised to reflect a more updated approach. For these reasons, the proposed FTA criteria were adopted for this project.

The conditions for mitigation were determined in a manner similar to the assessment performed for the Old Colony project. That is, (referring to Figure 1),

1. If the land use category lies within the FTA-defined "Severe Impact" zone, mitigation must be considered.

2. If the land use category lies within the "Impact" zone, and

   - the project does **not** cause a 5 dBA or more increase in the existing L_{dn}, then the site does not qualify for noise abatement measures;

   - the project causes a 5 dBA or more increase in the existing L_{dn}, but the mitigation measures do not meet cost-benefit criteria for reasonableness, then the site does not qualify for noise abatement measures;

   - the project causes a 5 dBA or more increase in the existing L_{dn}, and cost-benefit criteria are met, then the site qualifies for consideration of noise abatement measures.

2.1.2 Pure Tone Sources

One of the requirements of the Environmental Impact Report for this project was to provide a noise impact assessment that includes a pure tone analysis, at the property boundary and at the nearest

residence. This provision is taken in reference to the Massachusetts DEP Noise Policy (DAQC Policy 90-001) which states that:

> *A source o sound will be considered to be violating the Department's noise regulation (310 CMR 7.10) i the source: ...*
>
> *2. Produces a "pure tone" condition - when any octave band center requency sound pressure level exceeds the two adjacent center requency sound pressure levels by 3 decibels or more.*
>
> *These criteria are measured both at the property line and at the nearest inhabited residence....*

The annoyance caused by certain types of noise is often heightened by the their frequency content. This often occurs in the form of "pure tones," or peaks in the non-A-weighted sound pressure level frequency spectrum at one or more discrete frequency bands that can increase community annoyance. For some pure tone sounds, although the A-weighted overall sound level may appear to be low, the quality of the sound may result in a perceived higher level.

While noise generated by a passing train tends to be broadband in nature (i.e. the energy is distributed evenly over a wide frequency range and does not produce this "pure tone" effect), other project-generated noise sources such as train horns near grade crossings and locomotives idling at the layover facility may exhibit this tonal character that is considered to be more annoying than broadband noise.

While horn noise is in itself considerably higher in level than train noise and will be factored into L_{dn} for the general train noise impact assessment, separate consideration must be given to the frequency-dependent characteristics of this type of noise. Since federal regulations require trains to sound their horns at all established grade crossings, the DEP policy will be observed in order to adhere to the Massachusetts Noise Regulation.

Noise from idling locomotives is distinctly different from horn noise in that it is a stationary source has the potential for significant sound energy in the 30 to 80 Hz range. This enhances a low frequency "throbbing" quality which is not reflected in the A-weighted level, but still causes annoyance.

2.1.3 Traffic Noise

The significance of noise impacts from project-generated traffic near proposed commuter rail stations along the rail corridor will be assessed based on the projected noise increase relative to the noise from existing sources. This may be significant, since there will be new access roads introduced through some residential areas. Because the greatest changes in traffic volumes are expected to occur during peak travel periods, the noise increase will be evaluated in terms of the peak-hour L_{eq}, or Equivalent Sound Level. This descriptor represents the cumulative one-hour exposure that accounts for the fluctuations in A-weighted Sound Levels due to all sound sources during that hour.

Criteria for traffic noise impact will be based on existing FTA guidelines. According to these guidelines, a noise level increase of greater than 5 dBA is considered to represent a significant impact. The existing FTA criteria are used here rather than the proposed FTA criteria due to the general, non-site specific nature of the traffic noise impact assessment. This assessment predicts only the change in traffic noise resulting from the projected change in traffic volumes near the stations and not the absolute traffic noise levels at specific noise-sensitive locations in the community.

Due to the general nature of the traffic noise impact assessment for this project, the specific Federal Highway Administration (FHWA) noise abatement criteria are not applicable. However, it should be noted that the FHWA-recommended peak-hour L_{eq} noise measure has been adopted to evaluate noise impact due to traffic changes.

2.1.4 Construction Noise

The significance of short-term noise impacts from project construction activities were assessed based on the Annual Average Day-Night Sound Level (AAL_{dn}), with a criterion of 65 dBA for noise-sensitive areas. Because construction is a transient activity, the daily phase L_{dn} are averaged over a one-year period based on durations and schedules to determine the AAL_{dn} at nearby noise-sensitive receivers.

2.2 Vibration Impact Criteria

Project vibration impacts from train operations and from construction activities will be assessed based on the criteria summarized in Table 3 and described below.

Table 3. Criteria for Vibration Impact

IMPACT CATEGORY	SOURCE OF IMPACT	MEASURE OF IMPACT	IMPACT CRITERION
VIBRATION	Train-induced ground vibration at vibration-sensitive land uses.	Projected rms ground vibration velocity level (V_{dB}), existing level, and number of events.	Projected level exceeds Proposed FTA Criteria, and there is an increase in the vibration level or number of events.
	Ground vibration from construction at vibration-sensitive land use.	Projected rms ground vibration velocity level (V_{dB}).	Projected level exceeds Proposed FTA Criteria.
	Ground vibration from blasting at nearby structures.	Projected peak particle velocity (PPV) on ground.	Projected velocity > 0.5 inch per second.

2.2.1 Vibration from Trains

Vibration impacts from train operations were assessed based on the projected root-mean-square (rms) ground vibration velocity level (V_{dB}) measured on the exterior ground surface at the building line location closest to the track. This level is expressed in decibels relative to a reference velocity of 10^{-6} inch per second. The criteria are given in terms of velocity because the sensitivity of humans, buildings and equipment to vibration has typically been found to correspond to a constant of vibration velocity amplitude within the low-frequency range of most concern for environmental vibration (roughly 5 to 100 Hz). Although the peak particle velocity (PPV) is commonly used to quantify vibration amplitude for blast damage criteria, response to train vibration is better related to the rms amplitude, defined as the average of the squared amplitude of the signal over a one-second time period. Although velocity is normally described in units of inches per second in the USA, the decibel notation, which acts to compress the range of numbers required to describe vibration, can also be used.

The effects of ground-borne vibration include feelable movement of the building floors, rattling of windows, items on shelves and walls, and "rumbling" sounds. In extreme cases, the vibration can cause damage to buildings. However, building damage is not normally a factor for transportation projects, with the occasional exception of blasting and impact-type pile driving during construction. Annoyance with vibration often begins when the vibration exceeds the threshold of perception by about 10 dB. This is an order of magnitude below the damage threshold for normal buildings.

The annoyance criteria for ground-borne vibration impact are based on those currently being proposed

for adoption of the FTA, and are also consistent with those used for the vibration impact assessment of the Old Colony rehabilitation project. These criteria, presented in Table 4, are based on the maximum rms ground vibration levels for a single event and account for land use as well as the frequency of events. Because the project involves potential changes in train vibration along an existing rail corridor already in use, impact from existing rail traffic (Amtrak and Conrail operations) was assessed only at locations where (1) project ground vibration levels exceed the criteria **and** (2) there will be a significant increase in the vibration magnitude. For the proposed MBTA commuter rail service, impact was assessed at all locations where the ground vibration levels are expected to exceed the absolute criteria.

Table 4. Criteria for Train Vibration Impact

LAND USE CATEGORY	GROUND VIBRATION IMPACT LIMITS (rms Vibration Velocity Level in dB re 1 μin./sec)	
	Frequent Events[1]	Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations.	65 V_{dB}	65 V_{dB}
Category 2: Residences and buildings where people normally sleep.	72 V_{dB}	80 V_{dB}
Category 3: Institutional land uses with primarily daytime use.	75 V_{dB}	83 V_{dB}

[1] "Frequent Events" is defined as more than 70 vibration events per day. Most transit systems fall into this category.

[2] "Infrequent Events" is defined as less than 70 vibration events per day. This category includes most commuter and inter-city rail systems.

Another area of concern is damage to buildings located near the right-of-way. The significance criteria for vibration damage are 100 V_{dB} for buildings in general, and 95 V_{dB} for fragile, historic buildings. However, damage is extremely unlikely except in unusual cases or when the track will be very close to the structure.

2.2.2 Vibration from Construction

Significance criteria for construction vibration are essentially the same as for train operations, except

where blasting is anticipated. For blasting, a ground vibration peak particle velocity (PPV) limit of 0.5 in./sec is recommended, based on U.S. Bureau of Mines (BOM) studies.

3. EXISTING NOISE AND VIBRATION ENVIRONMENT

3.1 Noise Measurement Program

A noise measurement program was conducted between April 27-30, 1993 and May 19-21, 1993 at eight representative sites along the rail corridor between Framingham and Worcester. The locations of the measurement sites are shown on topographical plan maps provided in Figures 2 through 9. The sites were chosen such that at least one measurement of existing noise was performed in each municipality in which a new commuter rail station was planned, with two sites each located in both Worcester and Westborough. The objective of these measurements was to characterize the existing noise environment in areas that are likely to be affected by the different phases of the project.

At all but one site, long-term (24 hours or longer) measurements of existing ambient noise were performed using a Larson-Davis Model 870 Community Noise Monitor. The monitors were programmed to store each Hourly Equivalent Noise Level, or L_{eq}, as well as the statistical percentile sound levels L_n and noise events caused by train pass-bys in exceedance of a pre-defined threshold. Although the exact details of each train passage (speed, consist, etc.) during the measurement periods were unknown due to the unattended nature of the monitoring, these exceedances were processed and examined using database software to identify train passages from existing Amtrak and Conrail freight traffic on the corridor. Overall resulting L_{dn}s were calculated from the hourly L_{eq}s at each site, and the contribution to the L_{dn} by existing train traffic was estimated using the exceedance levels that were verified as train events. For all measurements, the microphone was mounted on a tripod positioned 5 to 7 feet above ground level and protected by a windscreen.

At the remaining site, attended short-term measurements were made of the noise (and vibration, described in Section 3.3) generated by passing Amtrak and Conrail trains, to compare the noise emission levels of the different train equipment currently operating with those planned for the project. These source measurements are described in greater detail in Chapter 4.

Figure 2. Site 1 - Shrewsbury St, Worcester

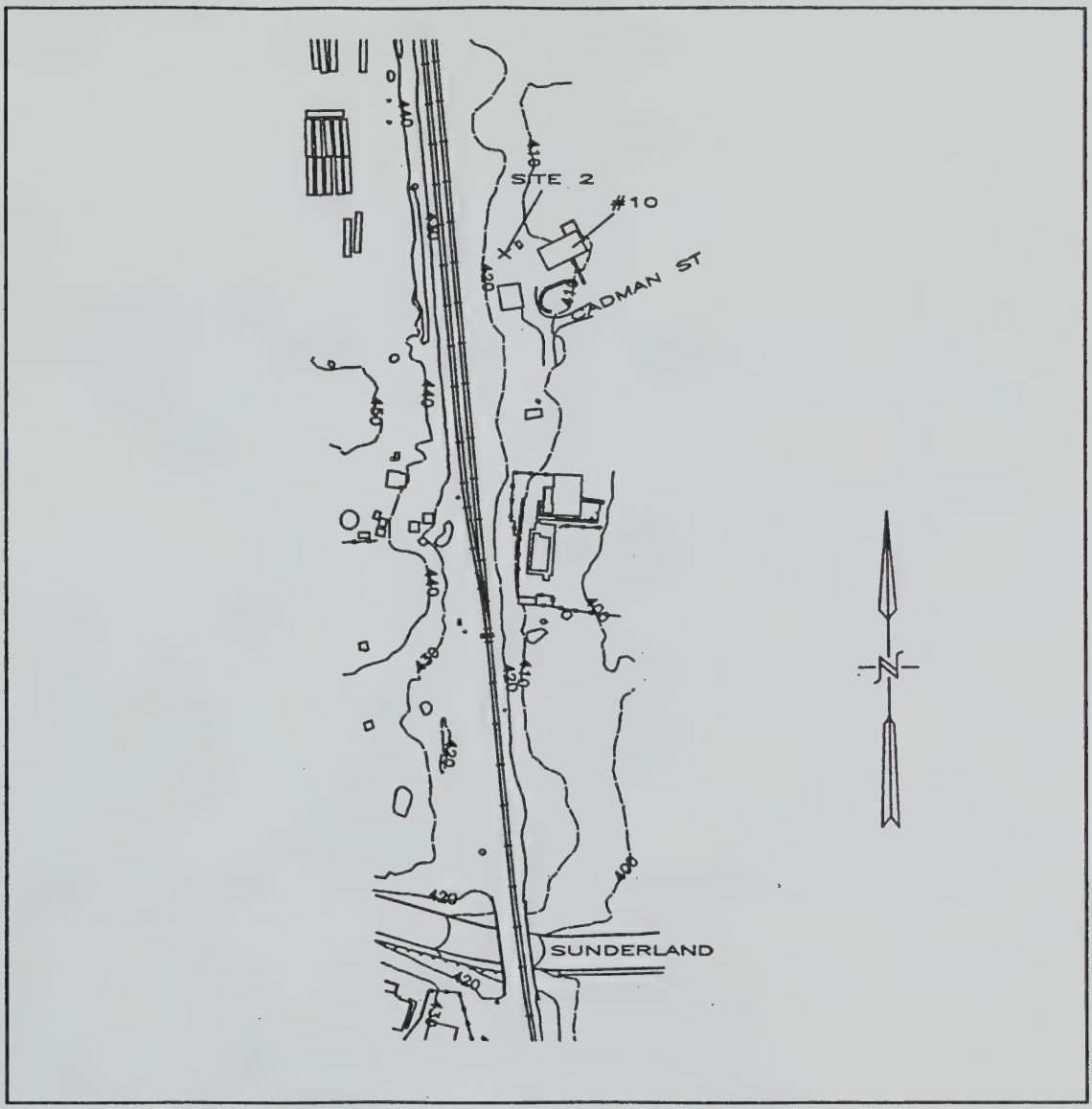


Figure 3. Site 2, Cadman St - Worcester

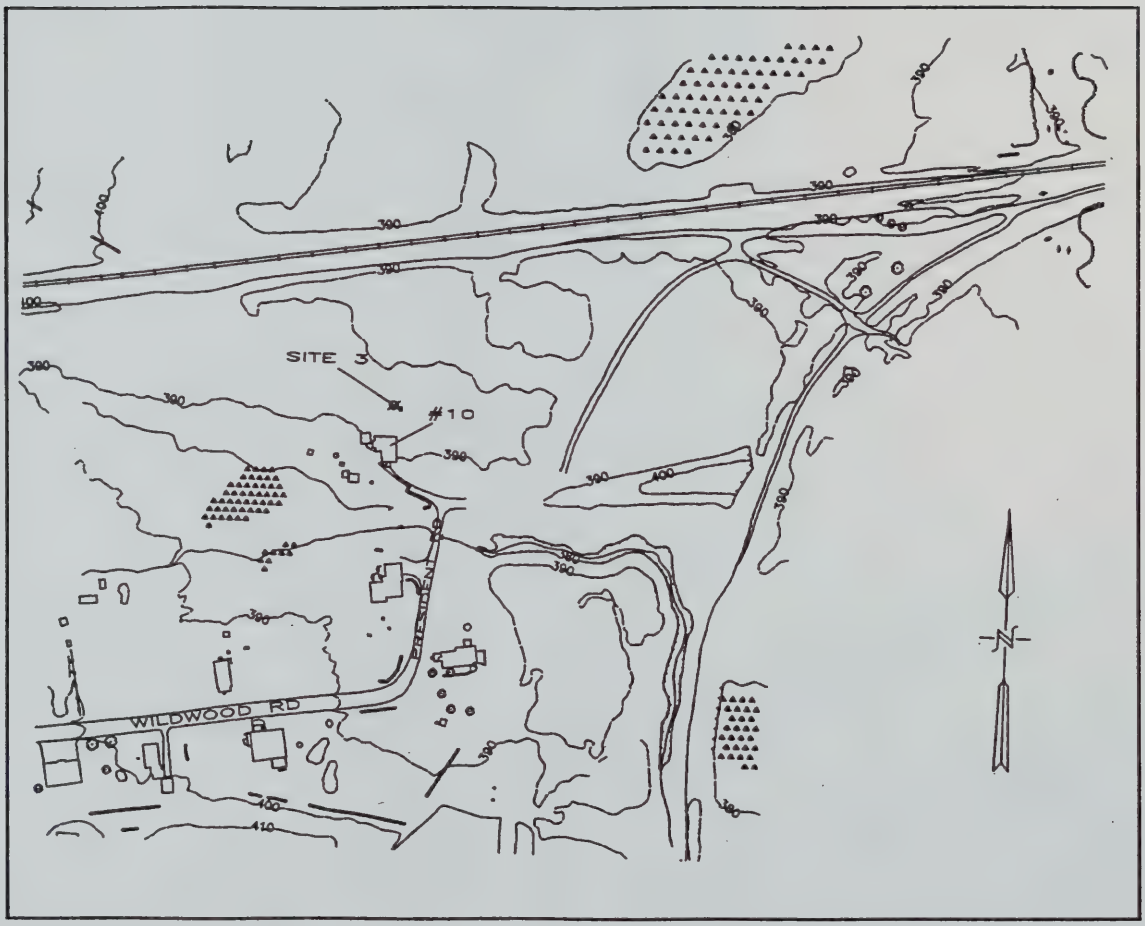


Figure 4. Site 3 - Wildwood Rd, Millbury

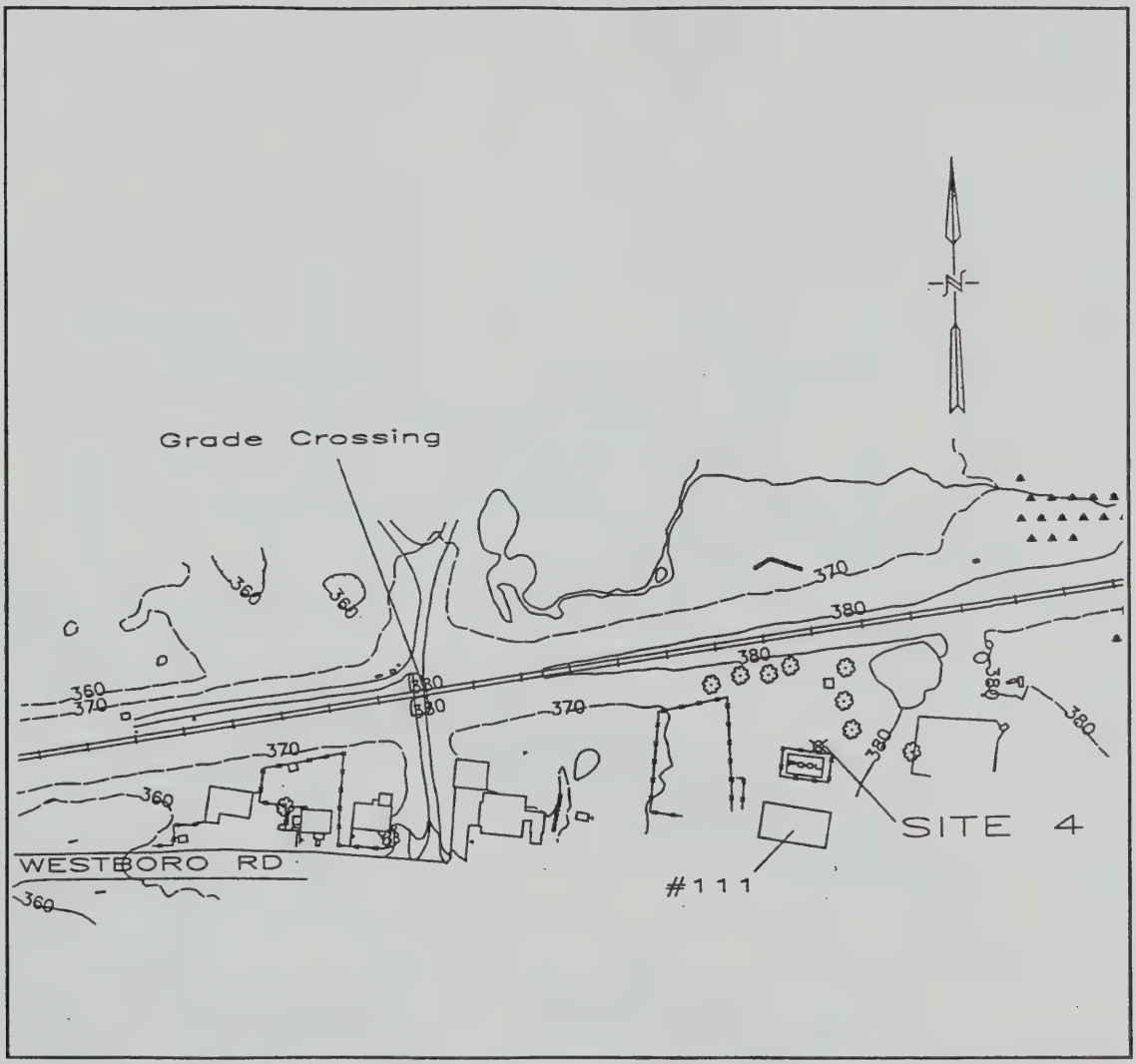


Figure 5. Site 4 - Westboro Rd, Grafton

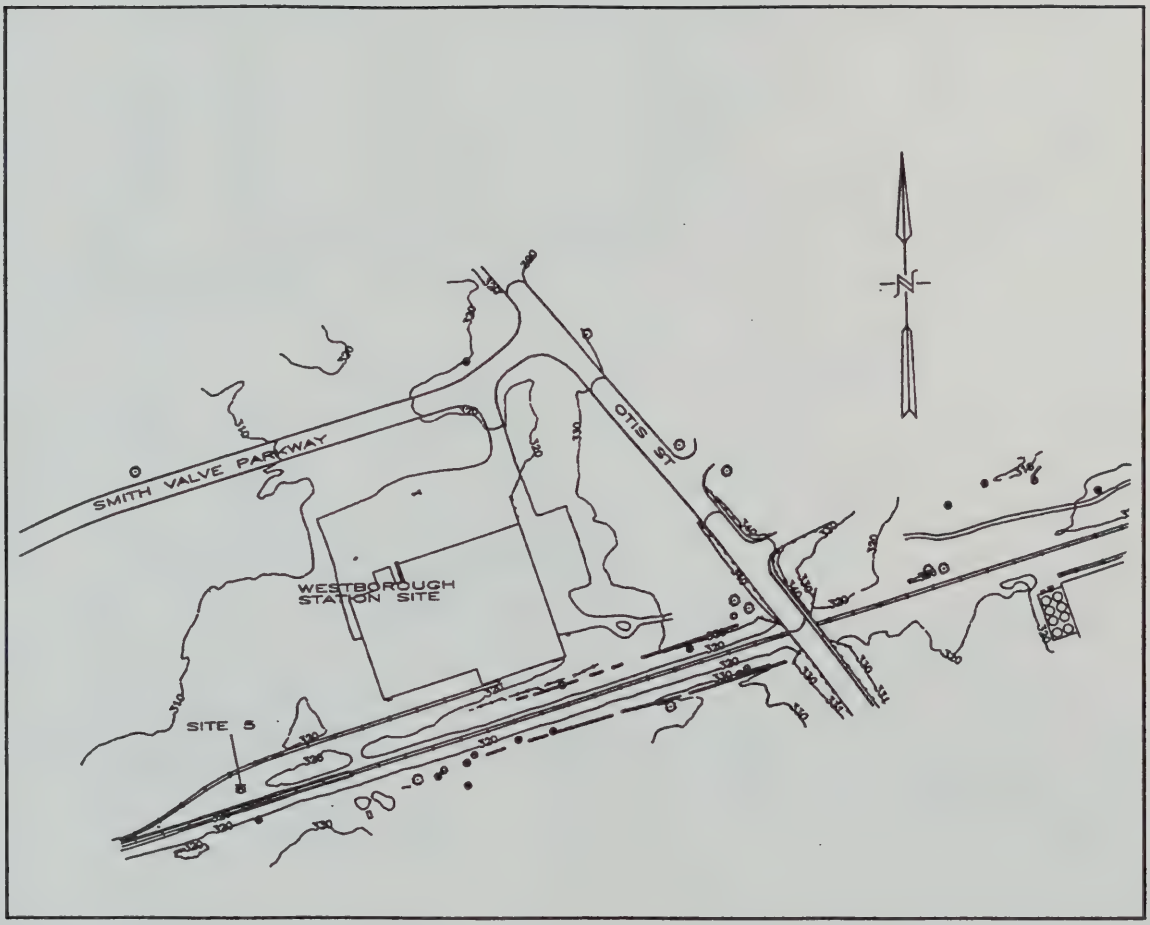


Figure 6. Site 5 - Smith Valve Parkway, Westborough

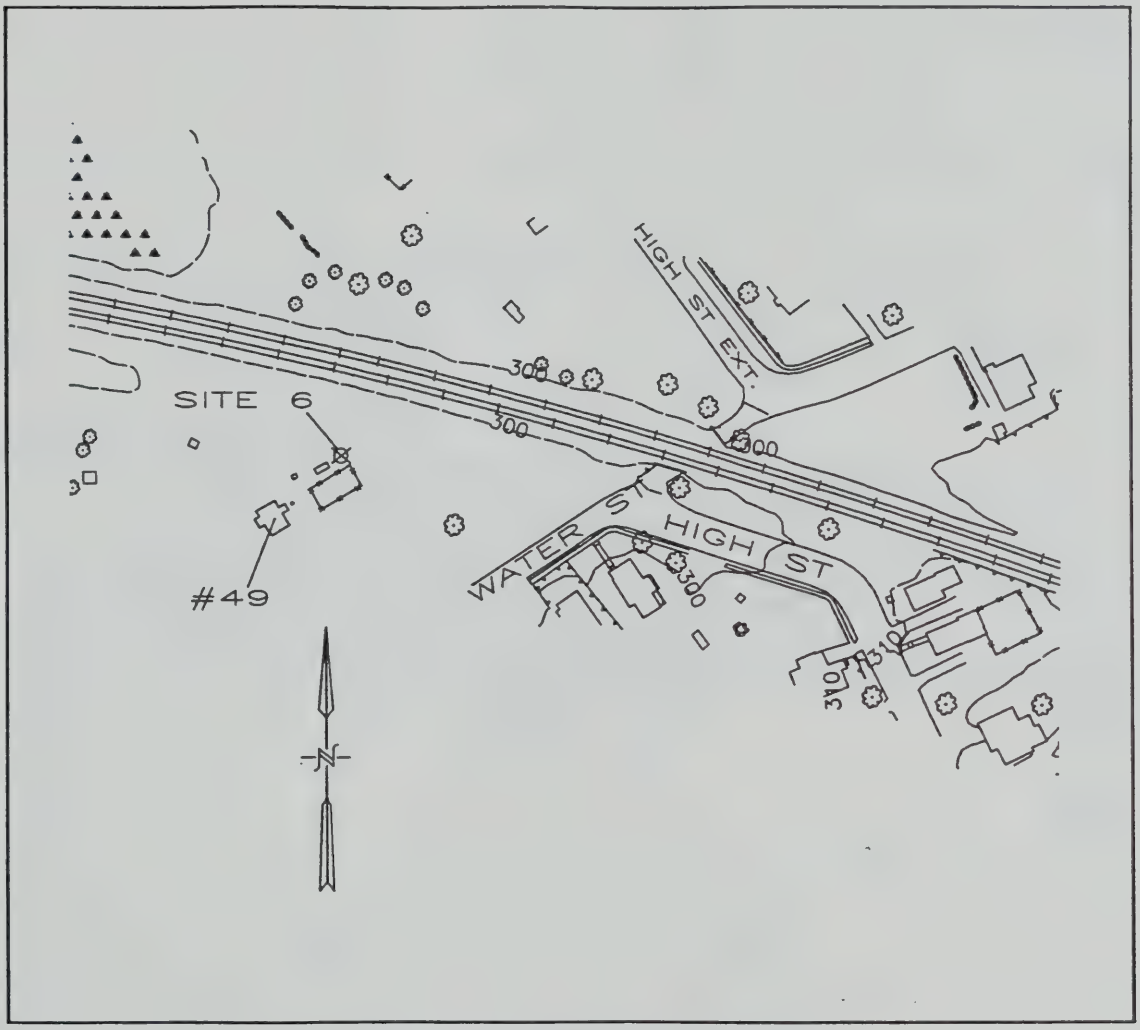


Figure 7. Site 6 - Water St, Westborough

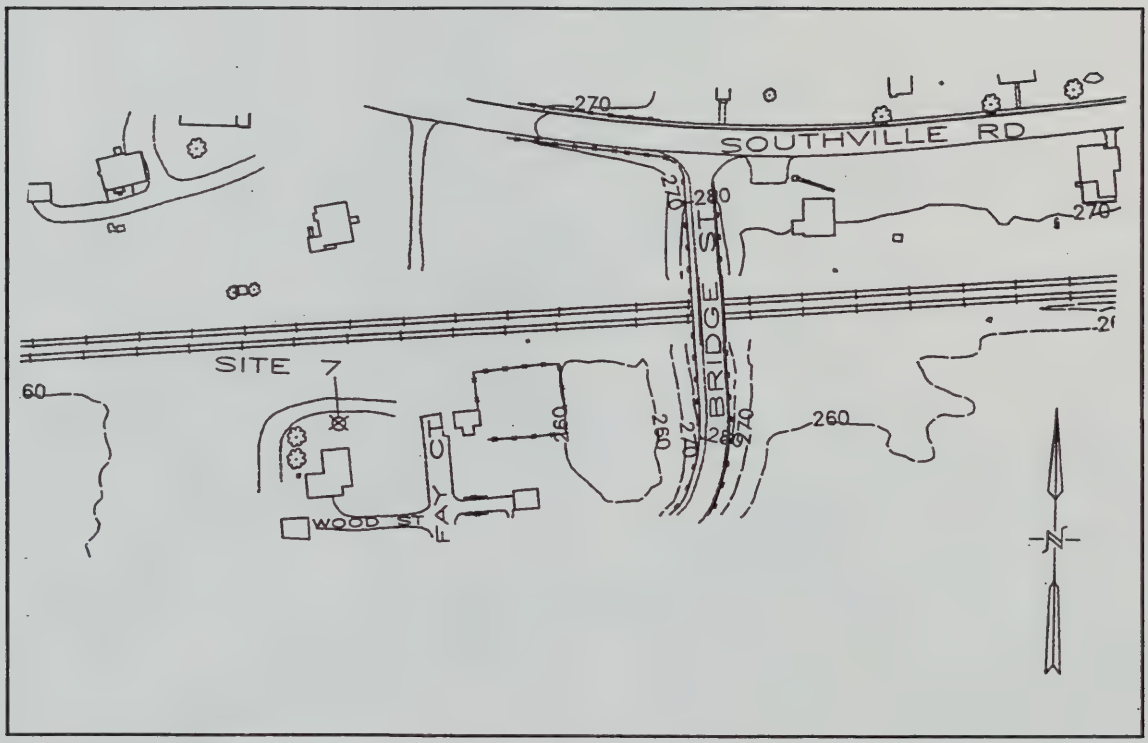


Figure 8. Site 7 - Fay Ct, Southborough

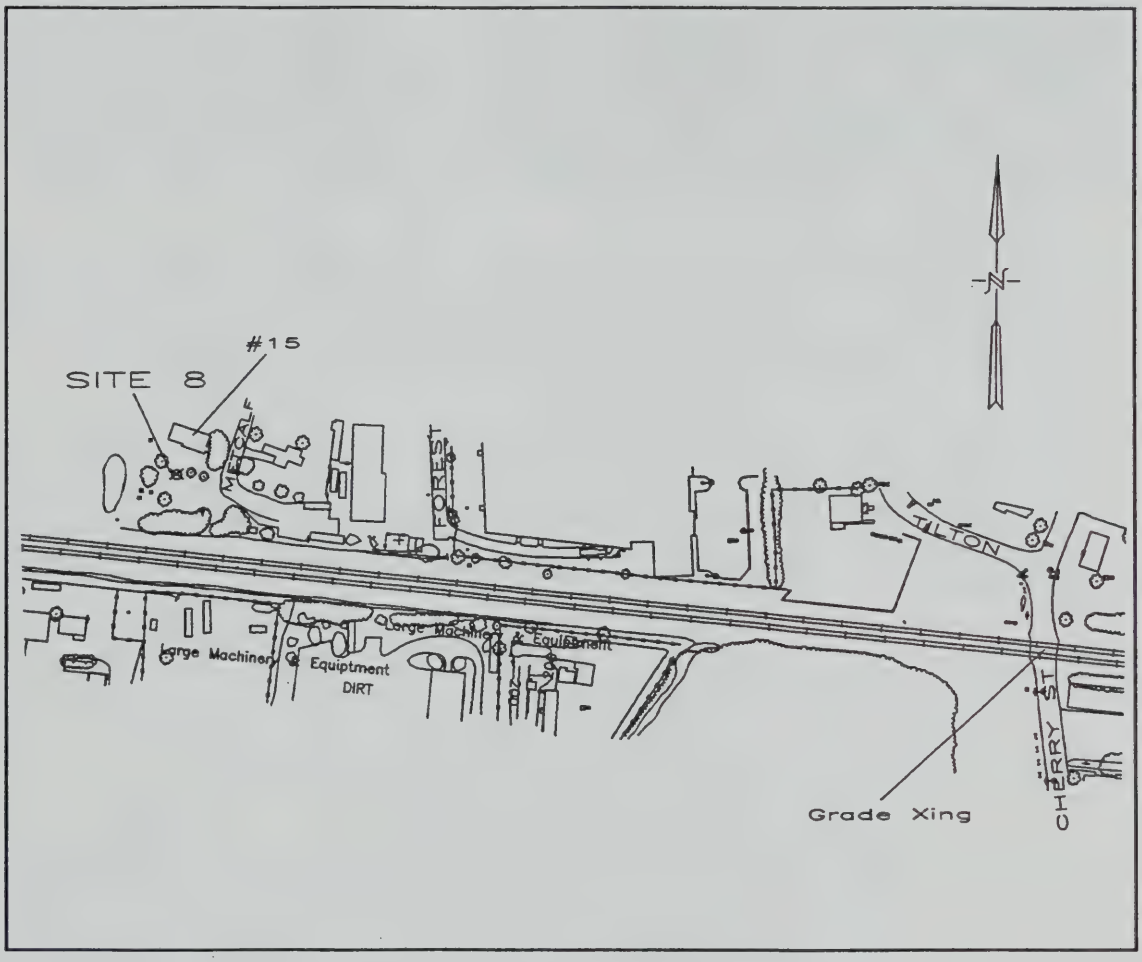


Figure 9. Site 8 - Metcalf St, Ashland

3.2 Noise Survey Results

The results of the 24-hour noise surveys are provided in Table 5, and are also presented by site in graphical format in Figures 10 through 23. For each site, the top graph shows the the hourly L_{eq} plotted over the measurement period, superimposed with the estimated L_{eq} in the absence of trains on the corridor. These plots give a good understanding of the extent to which train noise contributes to the 24-hour noise patterns under existing conditions. Each bottom graph then provides the six statistical levels obtained at each measurement site: L_1, L_{10}, L_{33}, L_{50}, L_{90} and L_{99}. L_{90} is a good indicator of the background level at a given location, while L_1 can be used to represent the levels generated by the highest noise events, which are in most cases caused by train passages.

The results indicate that trains, with the exception of Site 1, are the dominant existing noise sources over a 24-hour period at all of the sites. Although relatively infrequent, these train events, particularly freight trains occurring during nighttime hours, make a significant contribution to the daily L_{dn}. These L_{dn}s range from 62 to 77 dBA, with train-contributed L_{dn}s ranging from 62 to 70 dBA.

For Site 1 in downtown Worcester, trains appear to have little effect on the total noise environment, given the slower train speeds as they approach the station and the high ambient noise contribution from I-290. At the two sites located near grade crossings, Grafton and Ashland, the results show especially high noise levels from trains, primarily due to horns being sounded well before the train reaches the grade crossing.

Table 5. Summary of Existing Noise Measurement Sites

SITE	ADDRESS	START DATE/TIME	DIST. TO CORRIDOR CENTER (ft)	MEASURED L_{dn} (dBA)		MAX. HOURLY L_{eq} (dBA)	MIN. HOURLY L_{90} (dBA)
				Total	Trains		
1	50 Shrewsbury St., Worcester	5/19/93 10:00 am	425	76	67	73	56
2	10 Cadman Pl., Worcester	4/27/93 06:00 pm	50	65	65	66	40
3	10 President Rd., Millbury	4/27/93 06:00 pm	200	63	63	62	40
4*	111 Westboro Rd., Grafton	4/28/93 01:00 pm	100	70	70	75	35
6	49 Water St., Westborough	4/28/93 08:00 pm	100	62	62	62	37
7	1 Fay Ct., Southborough	4/28/93 06:00 pm	70	68	67	68	41
8*	15 Metcalf St., Ashland	4/29/93 07:00 pm	90	71	70	74	39

* measurement site located near grade crossing.

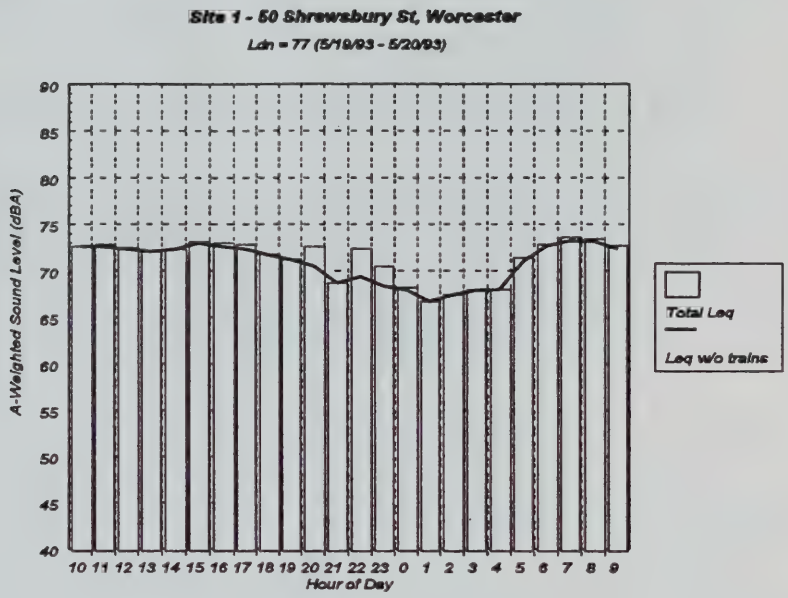


Figure 10. Site 1 Hourly L_{eq} Results

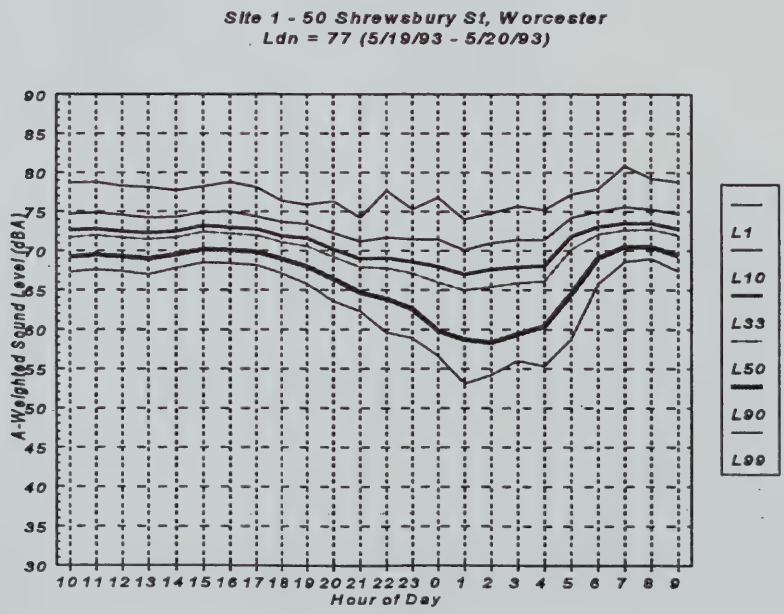


Figure 11. Site 1 Percentile Levels

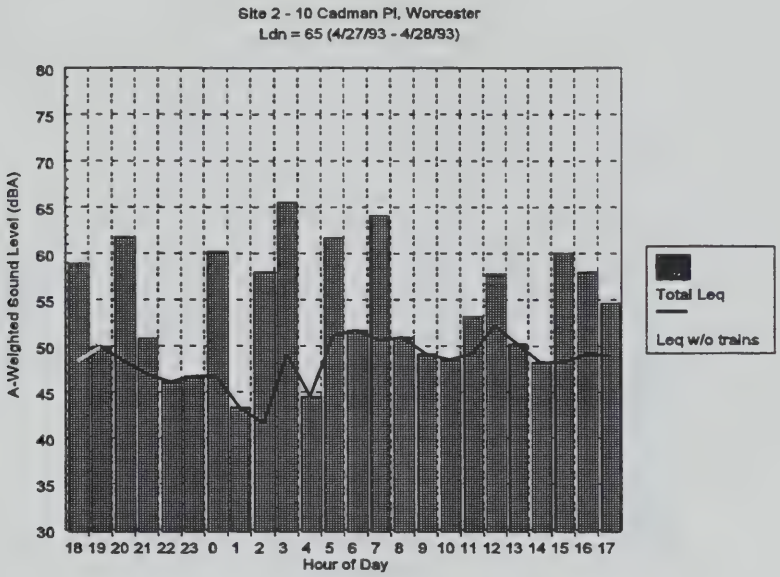


Figure 12. Site 2 Hourly L_{eq} Results

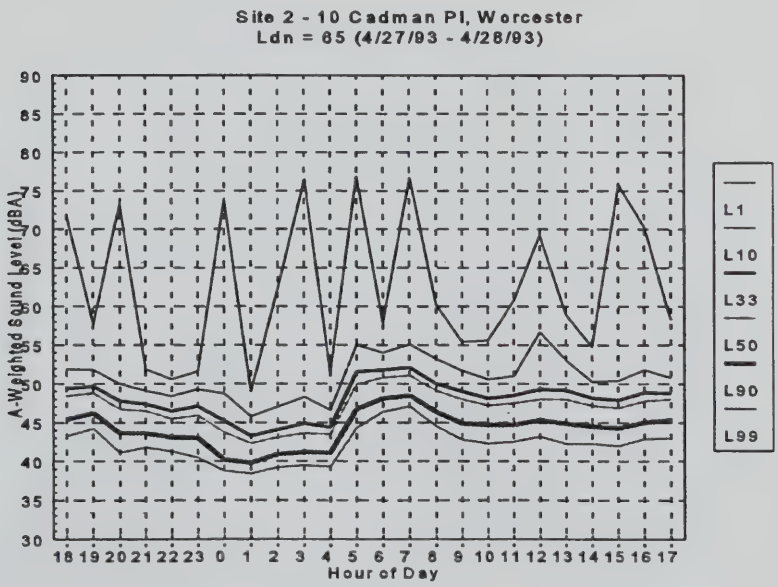


Figure 13. Site 2 Percentile Levels

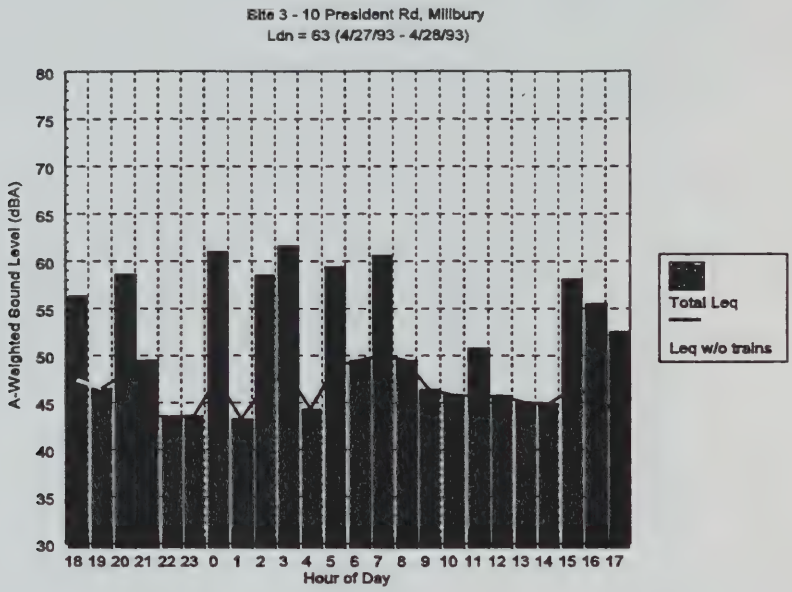


Figure 14. Site 3 Hourly L_{eq} Results

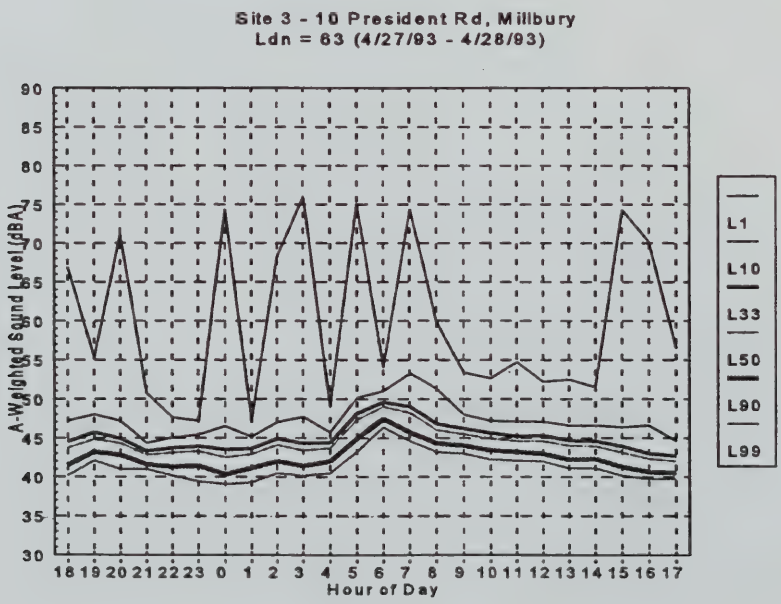


Figure 15. Site 3 Percentile Levels

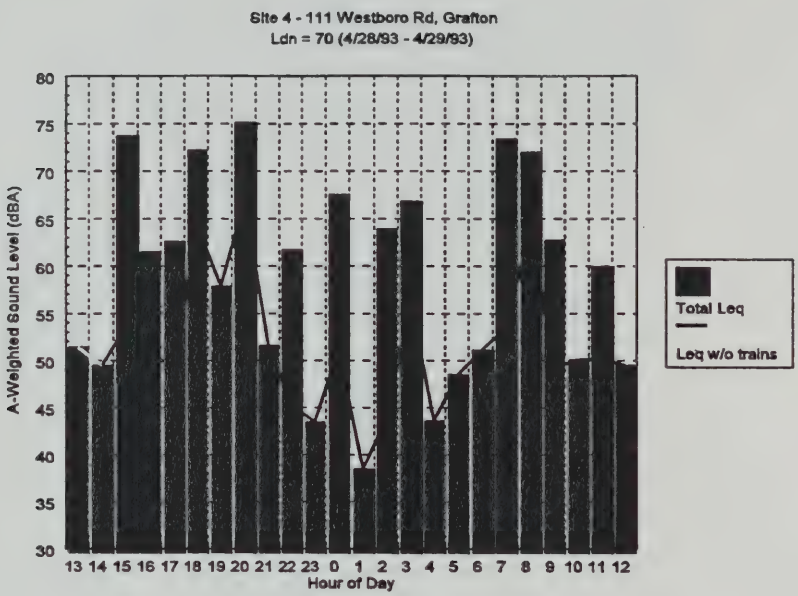


Figure 16. Site 4 Hourly L_{eq} Results

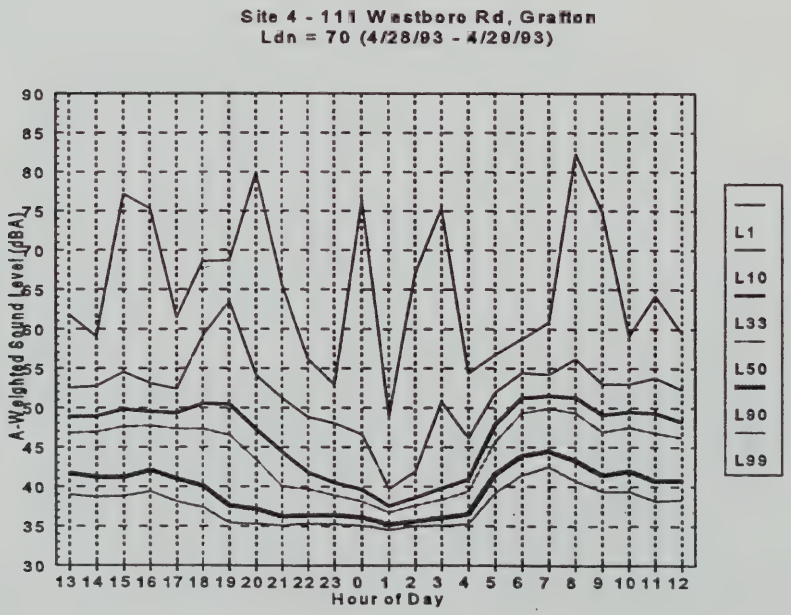


Figure 17. Site 4 Percentile Levels

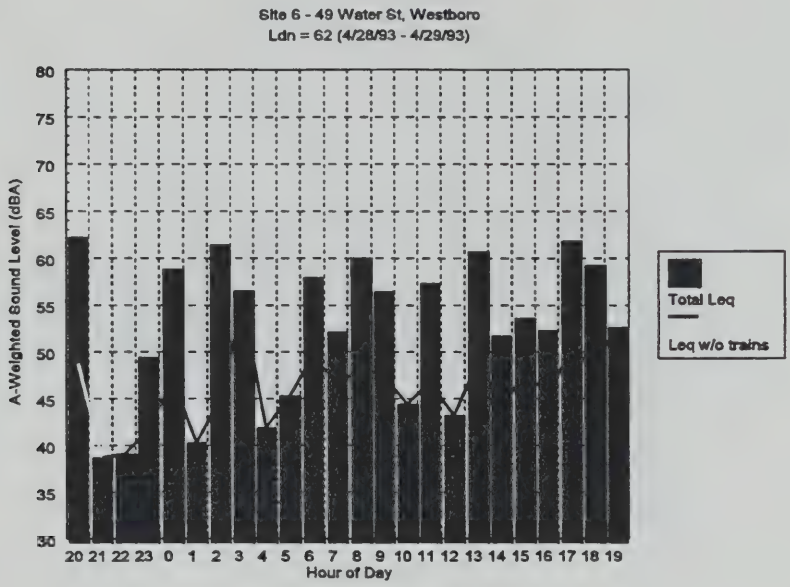


Figure 18. Site 6 Hourly L_{eq} Results

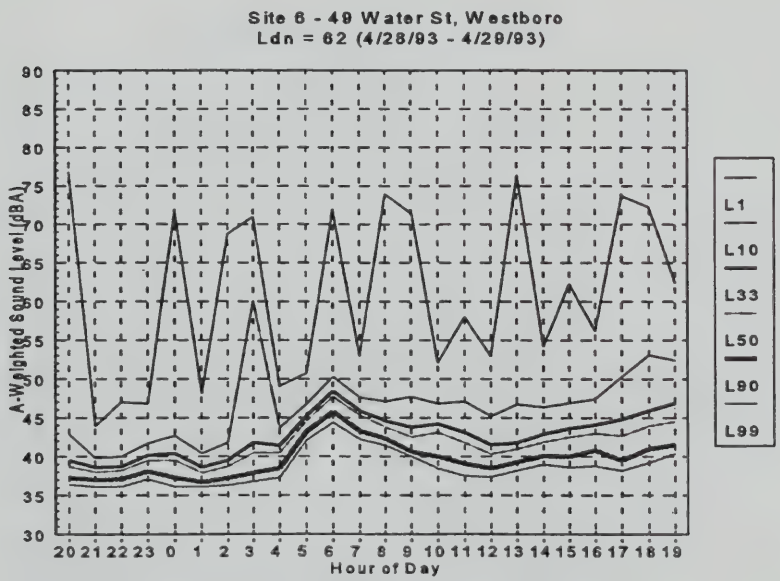


Figure 19. Site 6 Percentile Levels

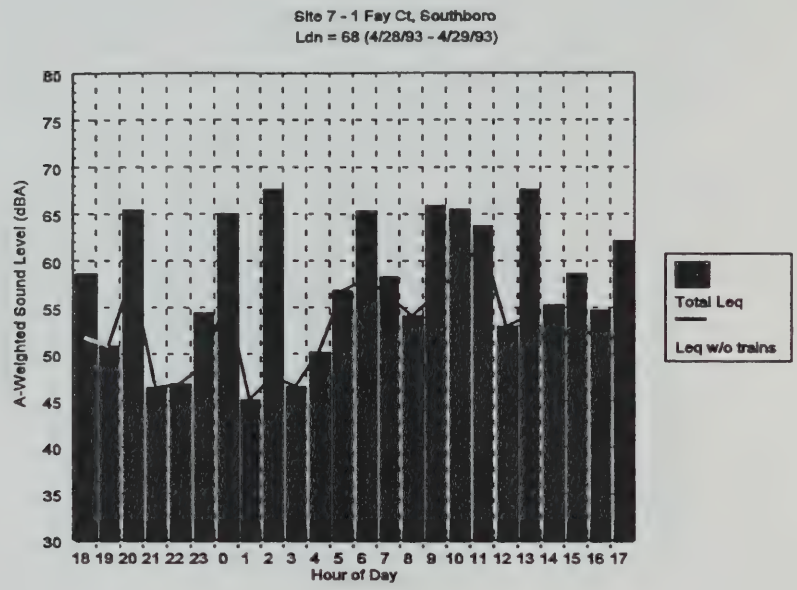


Figure 20. Site 7 Hourly L_{eq} Results

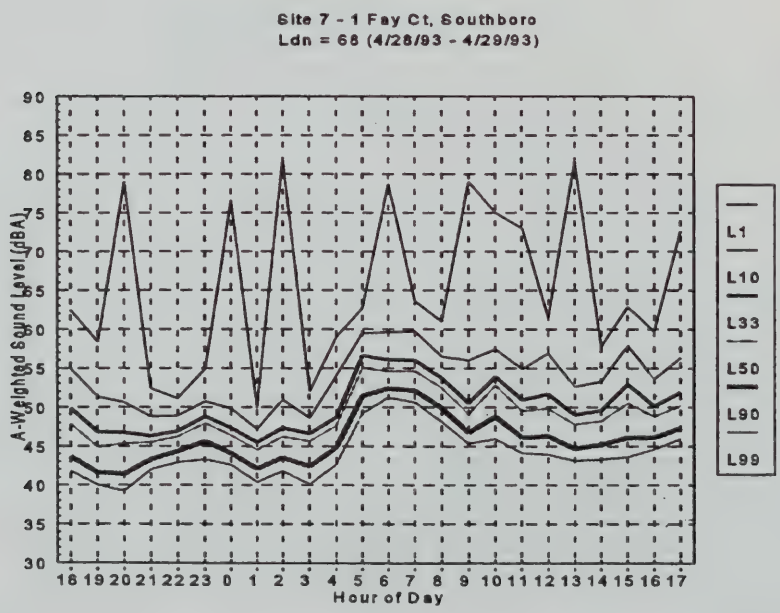


Figure 21. Site 7 Percentile Levels

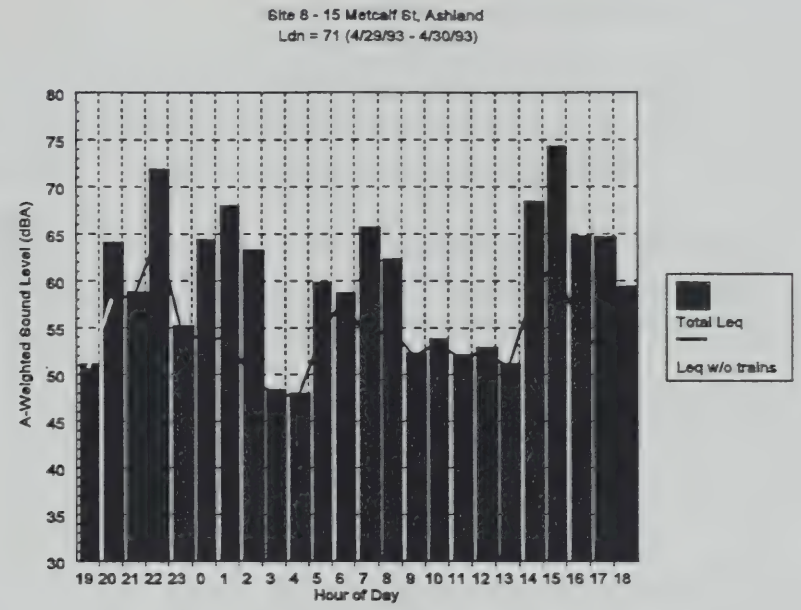


Figure 22. Site 8 Hourly L_{eq} Results

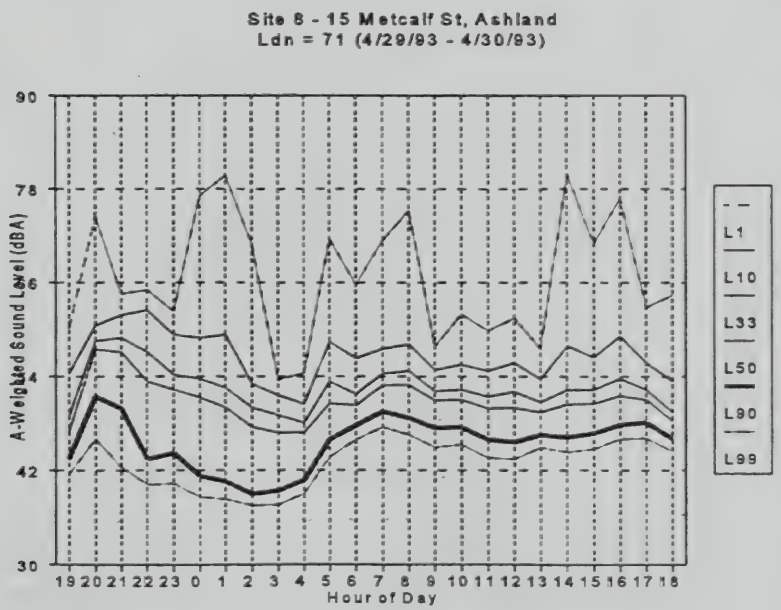


Figure 23. Site 8 Percentile Levels

3.3 Existing Vibration Measurements

Attended short-term train vibration measurements were performed along the project corridor at a non-residential location off Smith Valve Parkway in Westborough (Site 5), for the purpose of characterizing the existing vibration environment from trains on the railroad corridor. These measurements were performed concurrently with short-term noise measurements of six single train passages described below in Chapter 4. The vibration levels were documented for specific measurement distances, train consists and speeds and were also used, together with vibration level source measurements of MBTA commuter trains, to develop the train vibration projection model described in Chapter 8.

Because vibration propagation, or the rate at which ground-borne vibration decays as a function of distance, is dependent on area geology and other site-specific factors, simultaneous vibration measurements were made at four locations on the ground for each train passage. This type of measurement serves to characterize both the vibration source as well as the propagation path.

The test consisted of placing four vibration transducer, or accelerometers, mounted vertically on the ground at increasing perpendicular distances from the existing railroad track. Three PCB Model 393 accelerometers and a Wilcoxon Model 731 accelerometer were used, oriented to measure rms vibration acceleration in the vertical direction, and were mounted on ground-driven steel stakes using putty to secure them.

The data were recorded on magnetic tape using a Teac Model RD-130TE digital audio tape recorder. For each event recorded in the field, the train consist and track location were noted, and the train speed was clocked using a stopwatch. During subsequent laboratory analysis, the tape-recorded data were played back and processed through B&K Model 2635 integrating charge amplifier and a Rion Model LR-04 graphic level recorder to provide a continuous record of the rms vibration velocity level at each measurement distance for each train event. The maximum vibration level obtained by sampling the velocity level with a slow (one-second) averaging time constant was determined for each train event.

Figure 24 presents a graphical summary of measured existing train vibration levels in the project corridor as a function of distance from track and are sorted by train type, either Amtrak or Conrail. The Conrail data are further separated into maximum levels generated by locomotive and freight car pass-bys. This was done for the purpose of illustrating that the passage of the locomotive(s) almost always creates higher vibration levels than do the trailing freight cars, even though freight cars far outnumber locomotives in a typical freight consist.

A listing of the vibration levels measured for each train passage is given in Table 14 (Chapter 8), along

with specific information on train consist and speed. All data used to obtain the curves in Figure 24 were normalized to a single speed for each respective train type; namely, 40 mph for Conrail trains and 60 mph for Amtrak trains. The curves represent regression curves obtained by performing a least-mean squares curve fit on each group of data points, and more clearly illustrate the differences between vibration generated by the two train consists and types.

It can be seen that, with the exception of the higher levels generated by the passing locomotives, the vibration levels created by Amtrak trains and Conrail freight cars are nearly the same. These were the baseline conditions that were used in later developing the vibration projection model to assess potential for vibration impact from MBTA commuter trains.

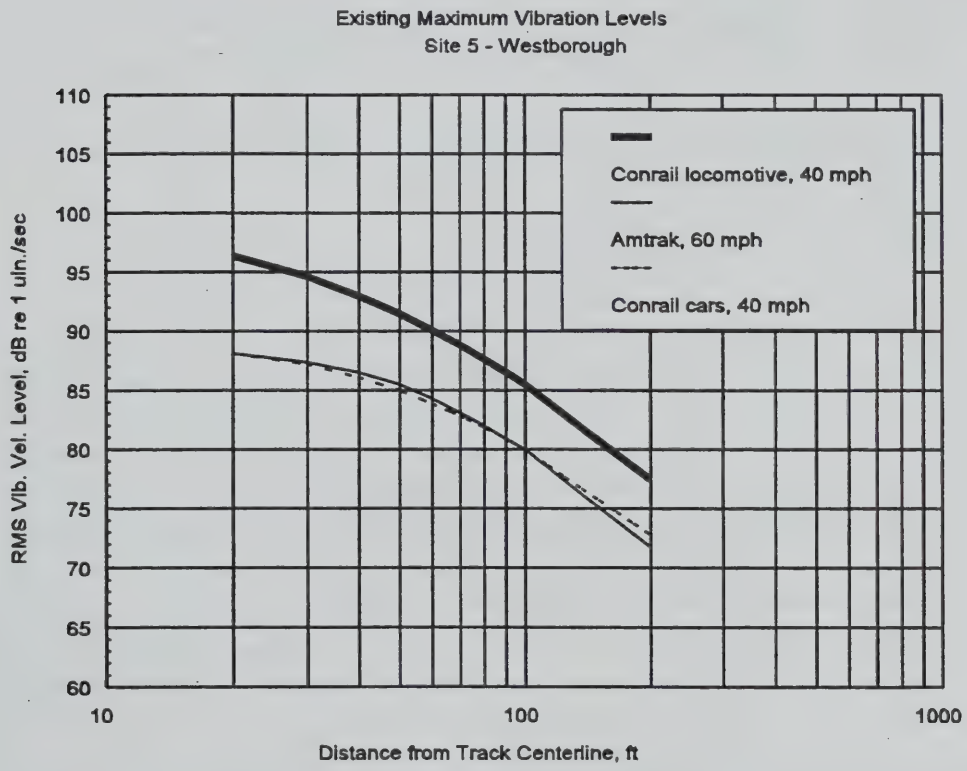


Figure 24. Measured Existing Vibration Levels from Trains

4. ASSESSMENT OF TRAIN NOISE

The major sources of noise from diesel locomotive-hauled trains are the locomotive exhaust and fans, and the noise generated by the interaction of steel wheels rolling on steel rails. The level caused by wheel/rail noise is strongly dependent on train speed, wheel condition, and rail condition. The locomotive noise is a function of engine throttle position and load, and is only weakly dependent on train speed. In addition, the propagation of locomotive and wheel/rail noise exhibit different directivity characteristics; noise from the locomotive tends to spread out spherically with distance (*monopole* radiation), while wheel/rail noise tends to be confined to a *dipole* radiation pattern, spreading out to the sides.

For these reasons, it is necessary to model the noise generated by the locomotive and the rail cars separately to account for different speed dependency and directivity characteristics. The following sections describe the process of (1) establishing noise source levels for the different equipment types through source measurements, (2) developing a single-event noise model of each train type, and (3) combining the noise levels cumulatively in order to assess the projected noise as compared with the criteria for impact.

4.1 Train Noise Source Measurements

In addition to the attended short-term measurements of train pass-by noise in Westborough (Site 5) indicated in Chapter 3, a similar measurement was also conducted outside the project area at a site in Natick, MA (Site 9) where MBTA commuter rail trains are currently in service. Each site was located near a straight, at-grade section of track where train speeds are relatively high. The data obtained from these measurements were used to document train noise levels for specific train consists and speeds, and to aid in the development of a train noise projection model for both the existing and future case.

At Site 5 off Smith Valve Parkway in Westborough, three Conrail trains and three Amtrak trains were monitored between 9:00 am and 4:00 pm on April 29, 1993. At Site 9 on Route 135 near Lake Cochituate in Natick, seven MBTA commuter trains and two Amtrak trains were monitored between 3:00 pm and 7:00 pm on May 1, 1993.

The sound signatures from each train passage were sampled using a Bruel & Kjaer (B&K) Model 2230 Sound Level Meter, and the output was recorded on digital audio tape using a Teac Model RD-130TE recorder. For each event recorded in the field, the exact train consist and track location were noted and the train speed was clocked using a stopwatch. During subsequent laboratory analysis, the tape-recorded data were played back into the sound level meter to determine the Maximum Noise Level (L_{max}) and

Sound Exposure Level (SEL) for each train event. Table 6 provides a listing of all train events monitored at Sites 5 and 9, including each L_{max}, SEL, speed and consist. These results were used to calibrate a noise projection model for each type of train consist: Amtrak, Conrail and MBTA.

Table 6. Summary of Train Noise Source Measurement Data

SITE	DATE	TRAIN DESCRIPTION			DIST. TO TRACK CENTERLINE (ft)	SPEED (mph)	NOISE LEVEL (dBA)	
		Type	#Loco	#Cars			L_{max}	SEL
5	4-29-93	Amtrak	1	2	50	45	89.0	89.5
			1	10	50	68	87.5	93.7
			1	3	50	46	86.5	89.0
		Conrail	1	9	50	40	90.5	95.9
			4	88	50	40	92.4	103.1
			1	0	50	40	82.8	84.5
9	4-30-93	Amtrak	2	9	50	60	92.2	98.7
			2	9	63	67	87.3	93.7
		MBTA	1	6	50	65	96.0	100.1
			1	6	63	65	95.0	98.7
			1	7	50	52	96.0	101.5
			1	7	63	49	91.1	97.0
			1	7	50	53	93.2	98.1
			1	6	50	60	92.5	96.2
			2	13	63	54	95.5	99.8

4.2 Train Noise Projection Model

This section summarizes the mathematical model used to develop a general model of train noise that is based on available measurements. The same basic model can be used for all types of trains including the diesel-locomotive hauled Amtrak, commuter and freight trains. Given the L_{max} of a train passby under a specific set of reference conditions, the model allows estimating L_{max}, SEL and other noise metrics for varying distance from the track, train speeds, train consists, and schedules. The standard approach is to model rail cars as moving, incoherent, dipole line sources (Rathe, 1977; Saurenman,

1982). This model is described by the following equations:

$$L_{max} = K + 10\ \log\left(\alpha + \frac{\sin(2\alpha)}{2}\right) - 10\ \log(y) + K_s\ \log\left(\frac{s}{s_{ref}}\right) - c_g - c_a - c_s$$

$$K = L_{max-ref} - 10\ \log\left[\alpha_{ref} + \frac{\sin(2\,\alpha_{ref})}{2y_{ref}}\right]$$

$$SEL = L_{max} + 10\log\left(\frac{len}{v}\right) - 10\log[2\alpha + \sin(2\alpha)] + 3.3$$

For locomotives, which can be modelled as moving monopole point sources, the corresponding equations are as follows:

$$L_{max} = K + 10\ \log(2\alpha) - 10\ \log(y) + K_s\ \log\left(\frac{s}{s_{ref}}\right) - c_g - c_a - c_s$$

$$K = L_{max-ref} - 10\log\left(\frac{2\alpha_{ref}}{y_{ref}}\right)$$

$$SEL = L_{max} + 10\log\left(\frac{len}{v}\right) - 10\log(2\alpha) + 3.3$$

The parameters which apply to the equations above are:

y	=	observer distance from track centerline, feet
y_{rej}	=	reference observer distance from track centerline, feet
len	=	train length, feet
len_{rej}	=	reference train length, feet
α	=	$\tan^{-1}(len/2/y)$
α_{rej}	=	$\tan^{-1}(len_{rej}/2/y_{rej})$

s	=	train speed, feet/second
s_{ref}	=	reference train speed, feet/second
v	=	train velocity, mph
L_{max}	=	maximum sound level during train pass-by, dBA
$L_{max\text{-}ref}$	=	L_{max} during train pass-by with reference conditions, dBA
K_s	=	speed-dependency coefficient (dimensionless)
c_g	=	excess ground attenuation, dBA
c_a	=	excess air absorption, dBA
c_s	=	excess shielding attenuation, dBA

Standard reference source levels were developed for locomotives and rail cars based on the source noise measurements at Sites 5 and 9. The above model was first used to predict the L_{max} and SEL for the observed trains, using available reference level data from the literature (FTA, 1990). The reference levels were then adjusted to minimize the discrepancies between energy-average predicted and measured noise levels. The results of this procedure yielded the source reference levels given in Table 7 below.

Table 7. Source Reference Levels for Train Noise Model

TYPE OF TRAIN	TYPE OF VEHICLE	TRAIN NOISE SOURCE REFERENCE QUANTITIES				
		Distance y_{ref} (ft)	Length len_{ref} (ft)	Speed s_{ref} (ft/sec)	Noise $L_{max\text{-}ref}$ (dBA)	Speed Coeff. K_s
Amtrak	Locomotive	50	56	73.3	88	10
	Rail Car	50	85	73.3	79	30
MBTA Commuter	Locomotive	50	60	73.3	91	10
	Rail Car	50	85	73.3	84	30
Conrail	Locomotive	50	60	73.3	91	10
	Rail Car	50	70	73.3	81	30

The source level results indicated that at identical speeds and receiver distance from the track, MBTA commuter trains generated the highest noise levels from both locomotives and rail cars, even though the same type of locomotives are used by Amtrak. It is not known exactly which model locomotives were running on either passenger line, however, which may account for the discrepancy. It was assumed that the MBTA trains measured along the Framingham Line in Natick consisted mostly of the older model (1000-series) F40PH locomotives, since the levels measured were about 5 to 10 dBA louder than the reference values used in the Old Colony Environmental Impact Statement, for which only newer model F40PH-2C (1050-series) locomotives were assumed. The newer locomotives differ from the older

model in that they are equipped with separate engines for providing main locomotive power and "hotel" power (heating, lighting, etc.), allowing the main engine to be throttled down at low speed. The older locomotives must generally operate at a constant notch setting regardless of speed, because they rely on the main engine to provide hotel power, resulting in higher noise levels at low speed. The levels measured in Natick, presumed to be of the older locomotives, were used for this assessment to represent the worst-case project condition.

Differing equipment maintenance procedures and conditions for each of the three rail services operating on the corridor may also result in different noise levels, despite the fact that the trains are operating on the same tracks. This may account for the significant difference in rail car noise levels (5 dB) measured between Amtrak and MBTA trains. While the L_{max} generated by a locomotive comes primarily from the diesel exhaust and is not a strong function of speed, noise radiated from the rail cars is purely a result of the wheel/rail interaction, and can vary widely according to the condition of the wheel and/or rails.

Figure 25 shows the dependence of source strength on vehicle speed at a fixed distance for each specific type of vehicle related to this project. Plotted vertically in this figure is the source's maximum noise level during pass-by, while train speed is plotted horizontally. It can be seen that speed dependence is strong for rail car noise because it is caused by interaction of the wheels and rails. Wheel/rail noise has been shown to increase rapidly with increasing speed. Speed dependence is very small for locomotive noise because it is dominated by exhaust noise, and varies very little with vehicle speed. Locomotive horn noise exhibits no speed dependence because of the on/off nature of horn noise irrespective of speed.

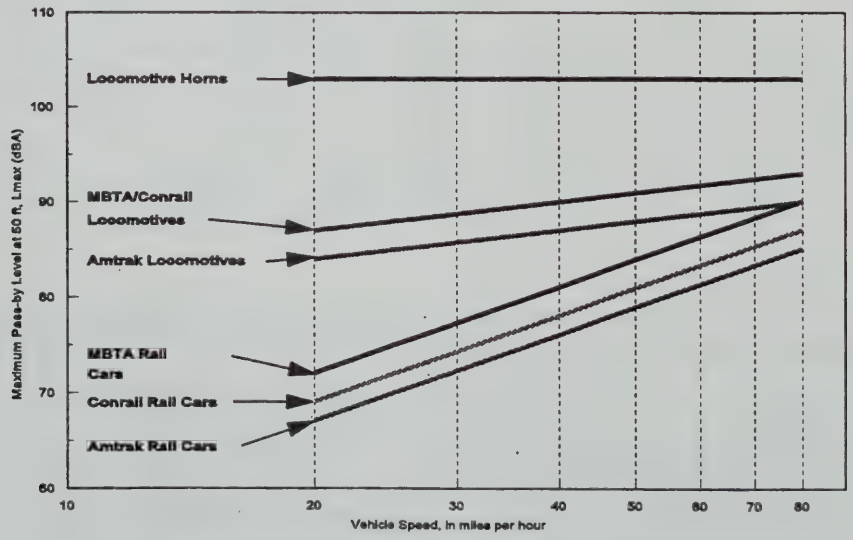


Figure 25. Dependence of Sound Levels on Vehicle Speed

The above discussion has concentrated on noise levels for single train passages. However, to project the overall daily noise exposure on which the impact criteria are based, the noise from all train operations that occur over a 24-hour period must be combined. The SEL, which is a measure of the total sound energy received from a single event such as a train passage, is used as the basis for computing the L_{dn}. This is given by the following equation:

$$L_{dn} = SEL + 10 \log(N_d + 10N_n) - 49.4$$

where:

$N_d =$ number of daytime trains per day
$N_n =$ number of nighttime trains per day

The basic train noise model described above provides a means for projecting train noise at close range under standard conditions. However, it does not take into account the excess sound attenuation at greater distances due to ground effects, atmospheric absorption or shielding. Furthermore, it does not account for the additional noise generated by trains in the vicinity of grade crossings or special trackwork (e.g. switches and crossovers). The extent to which these effects have been incorporated into the train noise model is described below.

4.2.1 Excess Sound Attenuation

Ground attenuation over flat ground depends on such factors as the height of the source and receiver above the ground, the type and condition of the soil, and the presence of any temperature or wind gradients. *Air absorption* of sound energy depends upon temperature and humidity, as well as on sound frequency and distance. Conservative assumptions were used to calculate the ground attenuation (c_g) and atmospheric absorptions (c_a), based on simplified models in the literature (Kurzweil, 1979).

Shielding attenuation (c_s) depends primarily on geometrical factors relating the noise source, receiver and intervening terrain or structures. Project-specific information with regard to these factors was obtained from visual surveys of the project corridor. Generalized assumptions for shielding attenuation were made based on typical track configurations using standard sound diffraction modelling techniques (Beranek, 1992). These assumptions are as follows:

- Deep Trench: Where the tracks are in deep cut or trench (15 to 20 feet), shielding attenuations of 11 dBA and 6 dBA were assumed for rail car and locomotive noise, respectively.

- Shallow Cut: Where the tracks are in a shallow cut (typically about 5-ft deep), a shielding attenuation of 8 dBA was assumed for rail car noise only.

- Embankment: Where the tracks are on embankment, a small (1 dBA) attenuation was assumed to account for the shielding of rail car noise by the edge of the embankment.

Finally, the shielding attenuation due to intervening buildings was estimated based on the method outlined in the FHWA Traffic Noise Prediction Model (FHWA, 1978).

4.2.2 Grade Crossings

4.2.2.1 Noise Projection Model

Noise exposure near at-grade crossings is typically dominated by horns that are sounded by trains as they approach the crossing. Therefore, the noise from grade-crossing signal bells was neglected for the purpose of the noise projections. Based on the measurements for this study, a reference source noise level of 103 dBA at 50 feet was determined for locomotive horns. Furthermore, the observations made during the measurements and from the 24-hour noise data suggested that the train horn noise occurred along a track segment about 1/4-mile long prior to the crossing. These conditions are consistent with the assumptions made for other railroad noise studies (FRA, 1978; HMMH, 1993).

Based on the above assumptions, the train horn SEL was calculated for representative locations, taken to be along a line perpendicular to the tracks, 100 feet prior to each grade crossing. The SEL was calculated by modelling the horns as moving, monopole point sources as follows:

$$SEL = L_{max\text{-}ref} + 10 \log \frac{(y_{ref})^2(\alpha_2 - \alpha_1)}{(s \cdot y)} - c_g - c_a - c_s$$

where:

$L_{max\text{-}rej}$ = 103 dBA at y_{rej}
y_{rej} = 50 feet
α_1 = $tan^{-1}(-1220/y)$
α_2 = $tan^{-1}(100/y)$

4.2.2.2 Pure Tone Analysis

Noise emitted by train horns was also investigated for its frequency content, to determine if pure tone qualities which result in greater annoyance are exhibited. As discussed in Section 2.1.2, horn noise has greater potential of generating pure tones than train noise, which tends to be broader band.

On May 10, 1993 sound recordings of Amtrak train passages were made near the Cherry Street grade crossing in Ashland. A B&K Model 2230 Sound Level Meter was placed 50 feet from the near track centerline, with the microphone positioned 5 ft above ground level. The output was recorded on digital audio tape using a Sony Model TCD-D10PRO recorder. Train consist, track location and train speed data were also collected. During laboratory analysis, the tape-recorded train and horn portions of data were played back using a Tektronix Model 2630 FFT Analyzer. The narrow-band frequency spectra obtained for the sound pressure signals were post-processed into octave band spectra for identification of pure tones. A typical spectrum is presented in Figure 26.

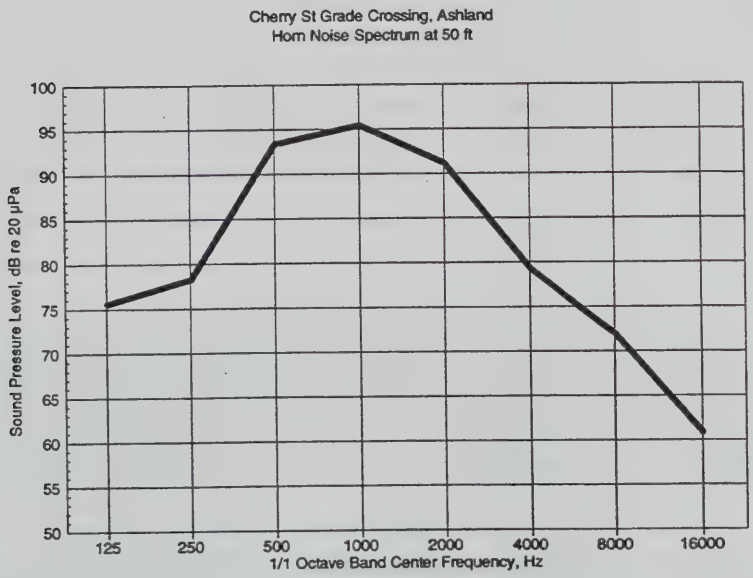


Figure 26. Grade Crossing Noise Spectrum

It can be seen that while the horn spectrum exhibits most of its sound energy in a few bands in the mid-frequency range of 500 to 2000 Hz, by the DEP definition it does not qualify as a pure tone. To be defined as a pure tone by DEP guidelines, the energy in either band adjacent to the peak frequency band of 1000 Hz must 3 dB below the peak level. The spectrum displayed here, as well as the spectra of other horn sound samples, do not show this characteristic and would not be considered in violation of the pure tone standard.

4.2.3 Special Trackwork

Special trackwork, associated with switches and crossovers, generated additional noise due to wheel impacts when trains pass over discontinuities in these track sections. Although the noise increase over special trackwork can be significant, on the order of 5 to 10 dBA at 50 feet, the noise effect becomes less pronounced at greater distances. This is because the impacts generated are point sources, with a sound attenuation rate twice that of the train's normal wheel/rail interaction, which acts as a line source.

As suggested by the above discussion, the noise effects of special trackwork are highly localized. Because they will affect noise levels only in localized areas, and because the project will not alter their locations, a detailed analysis of special trackwork would not significantly change the overall results of the train noise assessment. Therefore, a detailed assessment of the noise effects at each special trackwork location is not required for a reasonable assessment of overall noise impact.

4.3 Train Noise Projections

Projections of train noise, in terms of L_{dn} were carried out for the existing conditions and for the two future build scenarios: Basic and Full service. These projections were based on existing and projected train schedules, with conservative assumptions made regarding consists and speeds along the project corridor. A general summary of the basic operating assumptions is provided below in Table 8 for Amtrak, Conrail and MBTA trains.

Table 8. Summary of Train Operations

TRAIN SERVICE	EXISTING CONDITIONS				INTERIM / FULL SERVICE CONDITIONS			
	Max. Speed (mph)	Train Consist		# Trains per day	Max. Speed (mph)	Train Consist		# Trains per day
		# Loco.	# Cars			# Loco.	# Cars	
Amtrak	60	1	6	6	60/70	1	6	6
Conrail	40	1	30	10	40/50	1	30	10
MBTA	--	--	--	--	60/70*	1	9	8/32*

- Basic / Full Service

The train frequency for Amtrak service is based on the current Amtrak schedule (Spring 1993) and is assumed unchanged for either future scenario. All other train frequencies, including those of Conrail operations, were provided by Edwards & Kelcey (E&K).

Existing and future speed limits were provided by E&K, with actual intermediate speeds for passenger trains estimated using Train Performance Calculations (MBTA, 1992).

Projections of total noise along the project corridor were made by combining the train noise, predicted using the above model and assumptions, and the "background" noise level. As used here, background noise refers to the L_{dn} that would exist in the absence of any trains. The background levels along the corridor were estimated by generalizing the results at each of the noise measurement sites.

Table 9 indicates the generalized background noise levels that were applied for the areas where existing noise measurement sites were located. This table also provides a comparison of the noise levels measured at each site and the noise levels predicted using the train noise model and assumptions described above.

Given the variables involved, the model predictions agree reasonably well with the measured noise levels, within 3 dBA for all locations. Furthermore, because the predictions are based on a standard set of operating characteristics, variations in schedules and speeds during the measurements may have affected the agreement between projected and measured noise levels.

Table 9. Comparison of Predicted and Measured L_{dn}

SITE NO.	SITE LOCATION	Dist. to Corridor CL (ft)	EXISTING L_{dn} (dBA)			
			Est. Bkgd	Meas. Total	Pred. Total	Pred.-Meas.
1	Worcester	425	75	76	75	-1
2	Worcester	50	55	65	68	+3
3	Millbury	200	55	63	62	-1
4	Grafton	100	60	70	72	+2
6	Westborough	100	55	62	65	+3
7	Southborough	70	60	68	67	-1
8	Ashland	90	60	71	72	+1

4.4 Train Noise Impact Assessment

In addition to the summary of impacts due to train noise provided in Section 9 of the Draft EIR, Figures 27 through 33 illustrate the effects of the project by indicating the predicted L_{dn} from trains as a function of distance for the Existing, future Basic Service and future Full Service conditions in the vicinity of each of measurement site. It should be noted that these graphs assume no shielding from terrain features or buildings along the rail corridor.

Note that the relative difference between Existing, Basic and Full Service remain fairly consistent along the corridor. This is due to the fact that there is little variation in model parameters such as number of trains per day, and only variations in absolute level occur as a result of speed changes from segment to segment of the corridor. It is also evident that introduction of the Basic Service scenario will have less effect on the overall noise environment than the Full Service scenario(less than 1 dBA), given the twelve fewer trains scheduled per day.

Note that the curves shown in Figure 30 for Site 4 in Grafton show higher projected noise levels than all other measurement sites. The reason for this difference is that horn noise from the nearby grade crossing, which dominates the noise generated by train operations, has been included in the train noise projections at this location.

Table 10 provides a summary of noise impact screening distances by corridor milepost segment, based on projection models of train noise (and horn noise where applicable), estimates of the existing ambient levels and variations in track geometry, speed and schedule. The table also provides a breakdown of the number of residences within the impact distance for each milepost segment, which was used to develop the corridor-wide inventory of noise impacts from train operations associated with the project summarized in Table 9.6-2 of the DEIR.

Table 10. Noise Impact Screening Distances by Milepost Segment

SEGMENT ENDING	CITY/TOWN	MILEPOST		BASIC SERVICE		FULL SERVICE	
		FROM	TO	Distance to Noise Impact (ft)	No. of Residences within Impact Distance	Distance to Noise Impact (ft)	No. of Residences within Impact Distance
Framingham Sta	Framingham	21.3	21.3	--	--	--	--
	Framingham	21.3	21.5	25	0	25	0
Fountain St	Framingham	21.5	21.9	25	0	25	0
Winter St	Framingham	21.9	22.4	25	0	25	0
Ashland Line	Framingham	22.4	22.8	25	0	80	3
TOTAL	**Framingham**	**21.3**	**22.8**		**0**		**3**
Fountain St	Ashland	22.8	23.7	25	0	80	0
Sudbury River	Ashland	23.7	23.8	25	0	80	0
Main/Cherry GX's	Ashland	23.8	24.7	25	0	80	12
High St	Ashland	25.0	25.3	25	0	200	0
	Ashland	25.3	25.7	25	0	80	0
	Ashland	25.7	25.9	25	0	25	0
ASHLAND STATION	Ashland	25.9	26.0	25	0	25	0
	Ashland	26.0	26.3	25	0	25	0
Southboro Line	Ashland	26.3	26.4	25	0	25	0
TOTAL	**Ashland**	**22.8**	**26.4**		**0**		**12**
	Southboro	26.4	26.9	25	0	80	0
River St/Rt 85	Southboro	26.9	27.3	25	0	80	2
Southboro Sta	Southboro	27.3	27.4	25	0	80	0
	Southboro	27.4	27.5	25	0	25	0
SOUTHBORO STA	Southboro	27.5	27.6	25	0	25	0
Bridge St	Southboro	27.4	28.0	25	0	25	0
Westboro Line	Southboro	28.0	28.5	25	0	80	3
TOTAL	**Southboro**	**26.4**	**28.5**		**0**		**5**
Fruit St	Westboro	28.5	28.9	25	0	80	0
I-495	Westboro	28.9	29.5	25	0	80	0
	Westboro	29.5	29.8	25	0	80	0
Conrail Yard	Westboro	29.8	30.1	25	0	200	0
Rt 30	Westboro	30.1	32.0	25	0	200	0
Milk St/Rt 135	Westboro	32.0	32.7	25	0	200	24
	Westboro	32.7	33.0	25	0	200	4
	Westboro	33.0	33.2	25	0	150	3
Otis St	Westboro	33.2	33.4	25	0	200	0

Table 10. Noise Impact Screening Distances by Milepost Segment (cont'd)

SEGMENT ENDING	CITY/TOWN	MILEPOST		BASIC SERVICE		FULL SERVICE	
		FROM	TO	Distance to Noise Impact (ft)	No. of Residences within Impact Distance	Distance to Noise Impact (ft)	No. of Residences within Impact Distance
	Westboro	33.4	33.5	25	0	80	0
WESTBORO STA	Westboro	33.5	33.9	25	0	25	0
Arch St	Westboro	33.9	34.7	25	0	80	1
	Westboro	34.7	35.2	25	0	75	0
Grafton Line	Westboro	35.2	35.8	25	0	75	0
TOTAL	**Westboro**	**28.5**	**35.8**		**0**		**32**
Tufts Univ	Grafton	35.8	36.2	25	0	80	0
Pine St	Grafton	36.2	36.4	25	0	25	0
Grafton Sta	Grafton	36.4	36.5	25	0	25	0
	Grafton	36.5	36.9	25	0	25	0
Grafton GX	Grafton	36.9	37.2	25	0	65	4
	Grafton	37.2	37.5	25	0	80	0
Rt 140	Grafton	37.5	38.0	75	6	200	22
Millbury Line	Grafton	38.0	39.0	75	0	200	0
TOTAL	**Grafton**	**35.8**	**39.0**		**6**		**26**
	Millbury	39.0	39.5	25	0	80	0
MILLBURY STA	Millbury	39.4	39.6	25	0	25	0
TOTAL	**Millbury**	**39.0**	**39.6**		**0**		**0**
Rt 20	Worcester	39.6	39.9	25	0	75	0
Sunderland Rd	Worcester	39.9	40.2	25	0	65	2
Lake Park/Coburn	Worcester	40.2	41.5	25	0	65	2
Hamilton St	Worcester	41.5	41.7	25	0	80	3
	Worcester	41.7	42.3	25	0	65	0
Eastview Rd	Worcester	42.3	42.4	25	0	65	0
(Eastview Apts)	Worcester	42.4	42.6	25	0	80	4
Plantation St	Worcester	42.6	42.8	25	0	80	1
Draper St	Worcester	42.8	43.2	25	0	25	0
Putnam St	Worcester	43.2	43.9	25	0	80	2
	Worcester	43.3	44.1	25	0	25	0
	Worcester	44.1	44.2	25	0	25	0
Worcester Sta	Worcester	44.2	44.3	25	0	25	0
TOTAL	**Worcester**	**39.6**	**44.3**		**0**		**14**

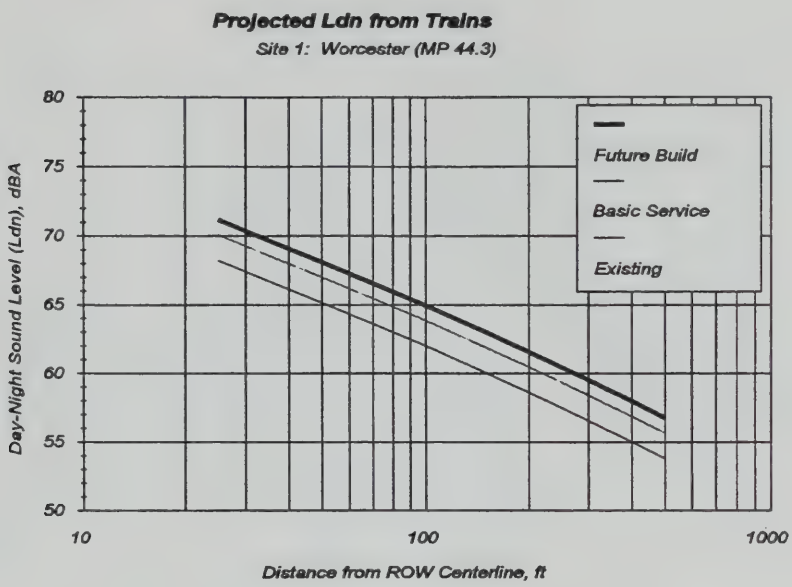


Figure 27. Projected Train Noise Levels near Site 1

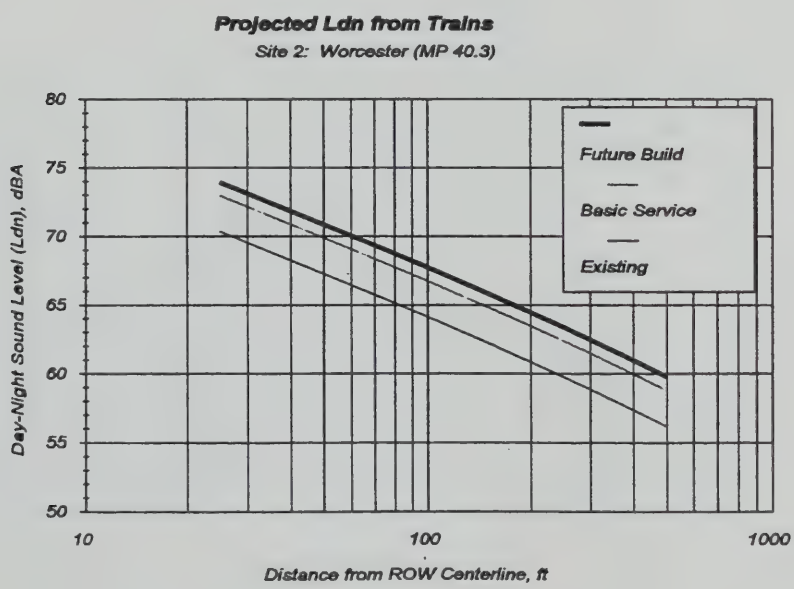


Figure 28. Projected Train Noise Levels near Site 2

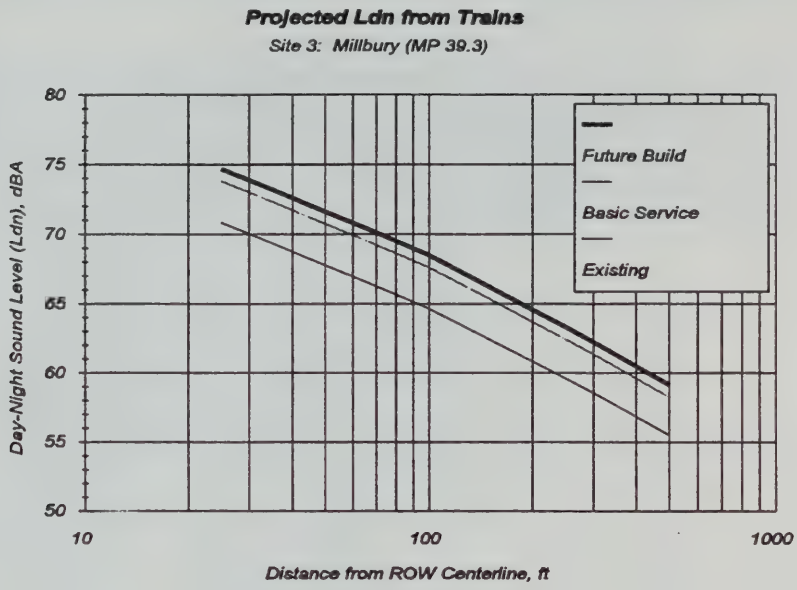


Figure 29. Projected Train Noise Levels near Site 3

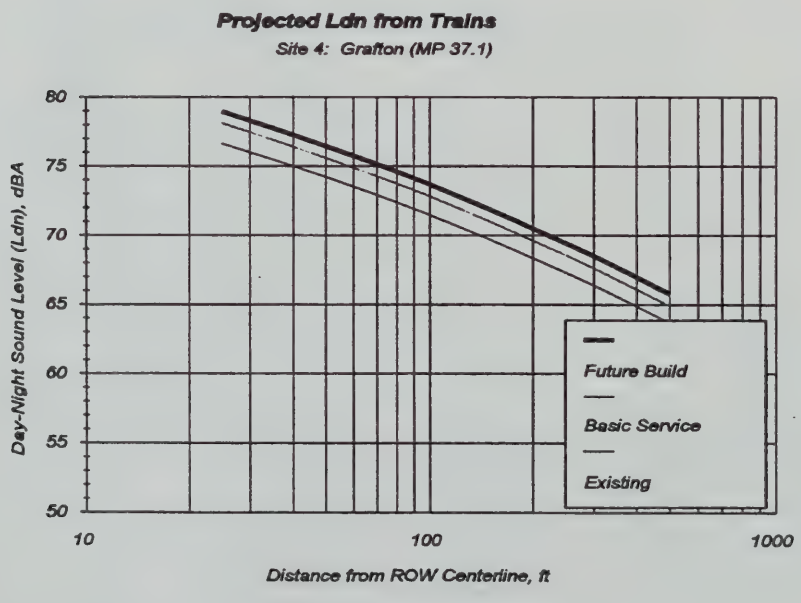


Figure 30. Projected Train Noise Levels near Site 4

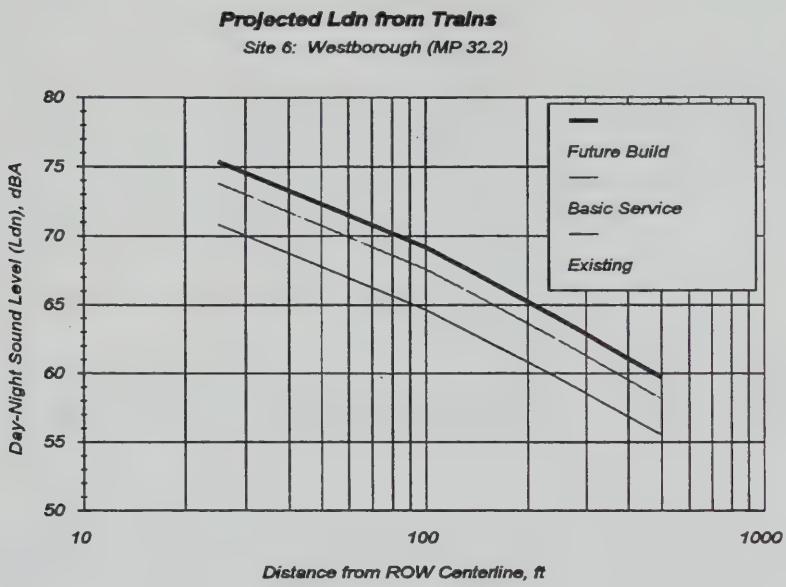


Figure 31. Projected Train Noise Levels near Site 6

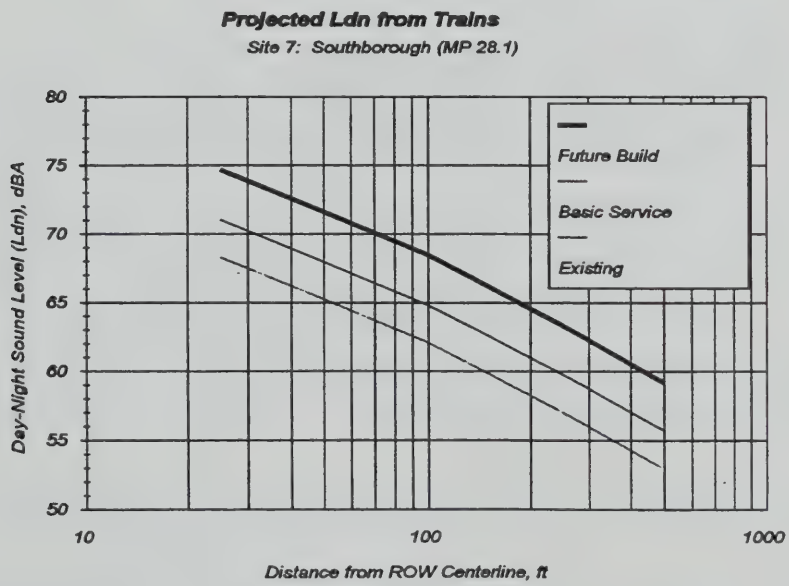


Figure 32. Projected Train Noise Levels near Site 7

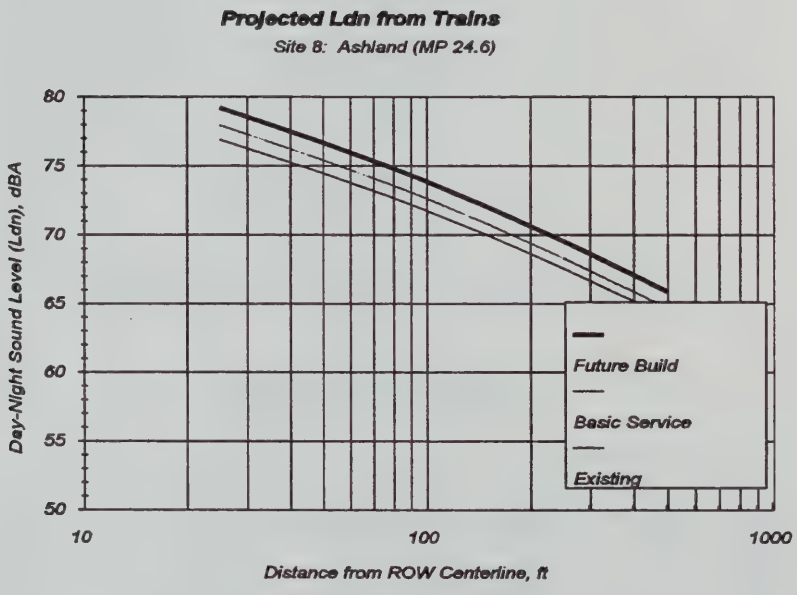


Figure 33. Projected Train Noise Levels near Site 8

5. ASSESSMENT OF LAYOVER FACILITY NOISE

Although the proposed layover facility in Worcester will be located in a largely industrial/commercial area with high ambient noise, an elderly apartment building (noise monitoring Site 1) and church will be situated within 300 to 400 ft of the facility. Noise from this facility, particularly during its nighttime activities, has the potential for raising the concerns of residents here.

5.1 Locomotive Noise Source Measurements

In addition to noise from moving trains, the noise characteristics of stationary trains in an existing locomotive storage/maintenance facility were also measured for the purpose of quantifying the noise effects of the layover facility.

Short-term noise measurements of idling diesel engine locomotives were conducted on June 7, 1993 at the Boston Engine Terminal in Somerville, MA. As with other attended source monitoring of noise, continuous tape recordings were made for each "event" using a B&K 2230 Sound Level Meter and Sony digital audio tape recorder. Events consisted of free-field sound recordings at increasing distances from the track (in 50 ft increments) for three different model locomotives in service, in varying modes of operation.

Continuous A-weighted sound levels were obtained from each sample of data, as well as corresponding octave band frequency spectra. All locomotives tested were the same basic General Motors F40PH type, with the only variable being model number. They are described briefly as follows:

- Engine #1003: 1000-Series, older model F40PH. Has only one engine for both main power and head-end power (for heat, lighting, ventilation, etc.). Test consisted of stationary engine idling under loaded conditions.

- Engine #1069: 1050-Series, newer model F40PH-2C. Has two separate engines for main power and head-end power. Test consisted of both engines idling under loaded conditions.

- Engine #1055: 1050-Series, newer model F40PH-2C. Test consisted of only main engine idling under loaded conditions.

- Engine #1031: MK-Series, rebuilt model F40PH. Test consisted of only main engine idling under no-load conditions.

The results are presented graphically in Figures 34 and 35, in the form of A-weighted L_{eq}. The graph in Figure 34 displays the L_{eq} for all tests and measurement positions, and indicates that the addition of the head-end power engine to the idling state significantly increases the continuous A-weighted noise level. This is further illustrated in Figure 35, in which a set of generalized regression curves of the L_{eq} is shown as a function of distance from the track. Figure 35 also suggests that noise emitted from only the main engine idling attenuates with distance at a slower rate than head-end engine noise. This may be related to differences in frequency content and is discussed below in Section 5.3.

5.2 Layover Facility Noise Projections

The continuous noise levels measured from idling locomotives were used to develop a single reference level to be used in the overall noise impact analysis for the proposed Worcester facility. It was assumed that the storage facility would be fully provided with an electric power source to maintain heat while the locomotive is shut down, thereby eliminating the need for the head-end power engine to be run at night.

An L_{eq} of 68 dBA at 50 ft was established as the reference noise level for a single trainset (from Figure 35, "Main Power only" curve). In addition, it was assumed that four trainsets would need to be stored in the facility each night after train service is shut down, resulting in a total L_{eq} of 74 dBA at 50 ft. It was assumed that the main locomotive engines of each would be started each morning no later than 5:00 am for the start of service scheduled for 6:00 am. However, in the case of extremely cold weather the possibility of the engines being run overnight was also explored to determine a duration threshold for onset of noise impact.

Figure 36 presents the L_{dn} as a function of distance computed for both scenarios, with the worst case defined as four locomotives idling from midnight to 6:00 am. It was found that for the one noise-sensitive land use identified, noise impact as defined by the criteria i) would occur under the 12 to 6 am idling condition, and ii) would **not** occur under the original 5 to 6 am scenario. The idling duration at which impact begins to occur would be about 2 nighttime hours.

5.3 Pure Tone Analysis

Another problem associated with idling locomotives is the low frequency characteristic of diesel engine noise. This often appears as pure tones in the 30 to 80 Hz frequency range that can cause increased annoyance. This low frequency noise can cause rattling of windows and other components in houses, and mistakenly generate complaints about vibration and community fears about the potential for structural damage to buildings.

Figure 37 shows the octave band sound pressure level spectra of the two different models of the MBTA locomotive fleet. Even though the A-weighted sound level of the newer 1050-series locomotive was shown to be lower than the 1000-series model, as illustrated in Figure 34, the older locomotive spectrum shows a distinct pure tone at about 30 Hz which the newer model does not. A-weighting accounts for the frequency sensitivity of the human ear to noise with "typical" frequency content, but tends to underestimate the loudness of sounds dominated by low frequencies.

Another characteristic of low frequency noise is that it tends to propagate and penetrate exterior walls with less attenuation than higher frequency noise. This was illustrated in Figure 35, where the main engine, which has greater low frequency content, attenuates more slowly than the condition of both engines idling, which contains higher frequency sound that masks the low frequency components.

The results would suggest that the continuous idling of the older model MBTA locomotives have the potential to cause annoyance associated with low frequency pure tones, and would be considered in violation of state noise policy. However, if efforts are made to store only the newer equipment in the Worcester layover facility, and limit nighttime idling of locomotives to the greatest extent possible, potential adverse impacts may be avoided. Other mitigation options may be to position stored trainsets as far away from residential land use as possible, or to build partial enclosures which would shield some of the noise generated.

While the train noise projections for the railroad right-of-way were made under the scenario of an older-locomotive fleet, this was a conservative assumption based on measurements of a limited number of trains on the existing Framingham Line. A more realistic scenario for the Worcester Commuter Rail Extension would likely be a mix of new and older locomotives. Since the measured levels of the 1000-series locomotive were in fact lower than those of the newer models, the worst-case condition is preserved in the layover facility model. In other words, while this is seemingly in conflict with the moving train noise model, both models are based on a conservative interpretation of the data.

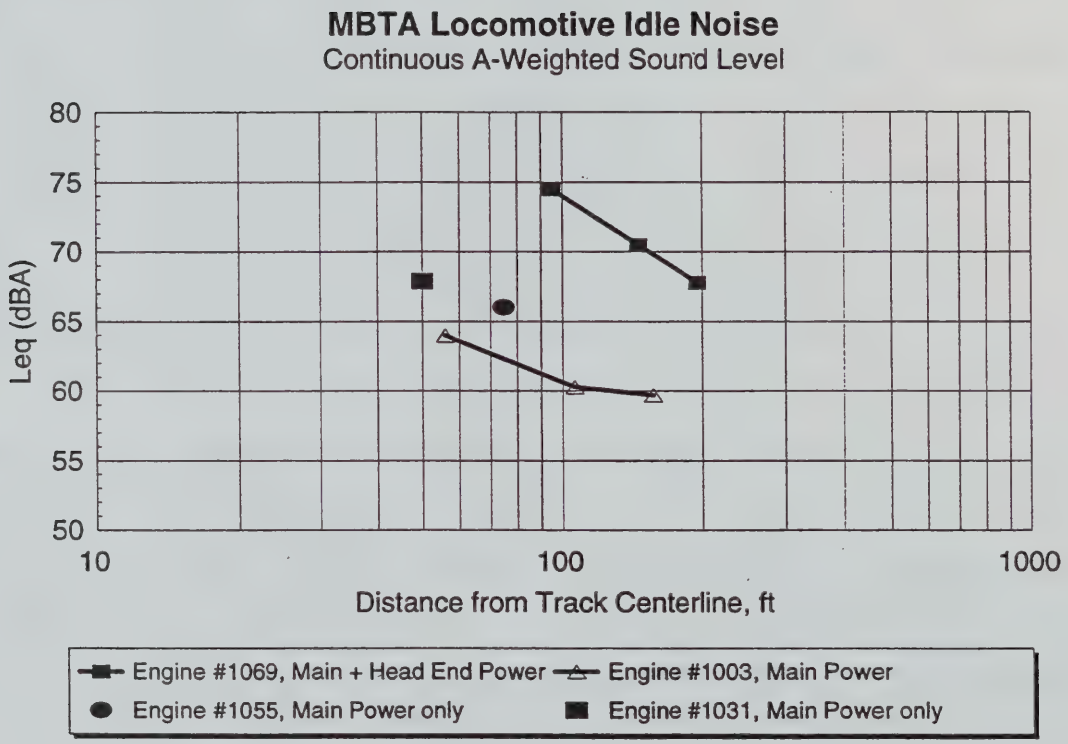


Figure 34. Measured Locomotive Idling Noise Levels

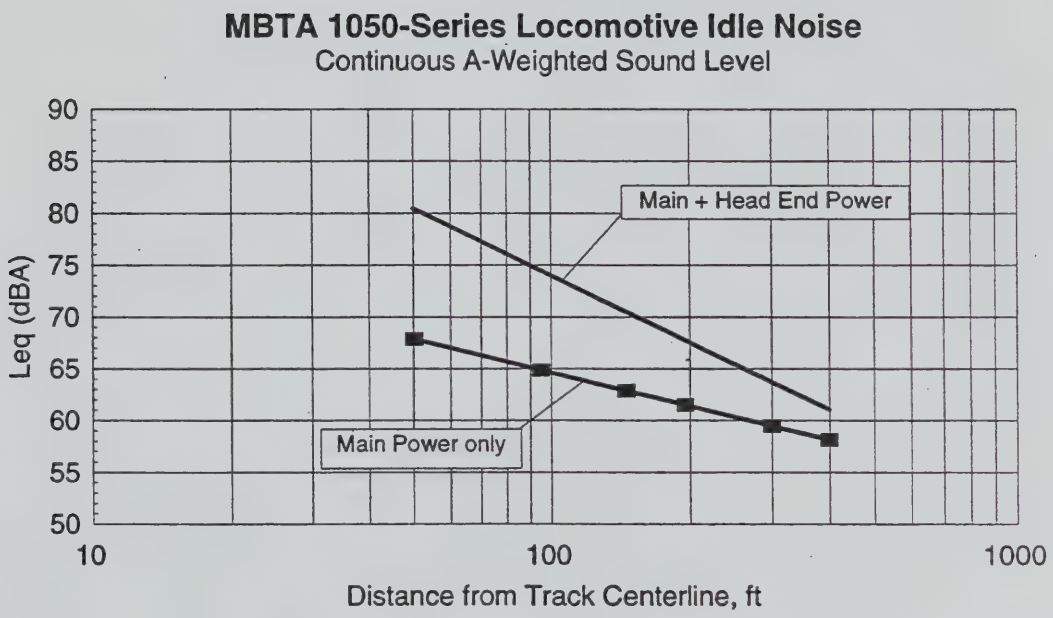


Figure 35. 1050-Series Locomotive Idling Noise Characteristics

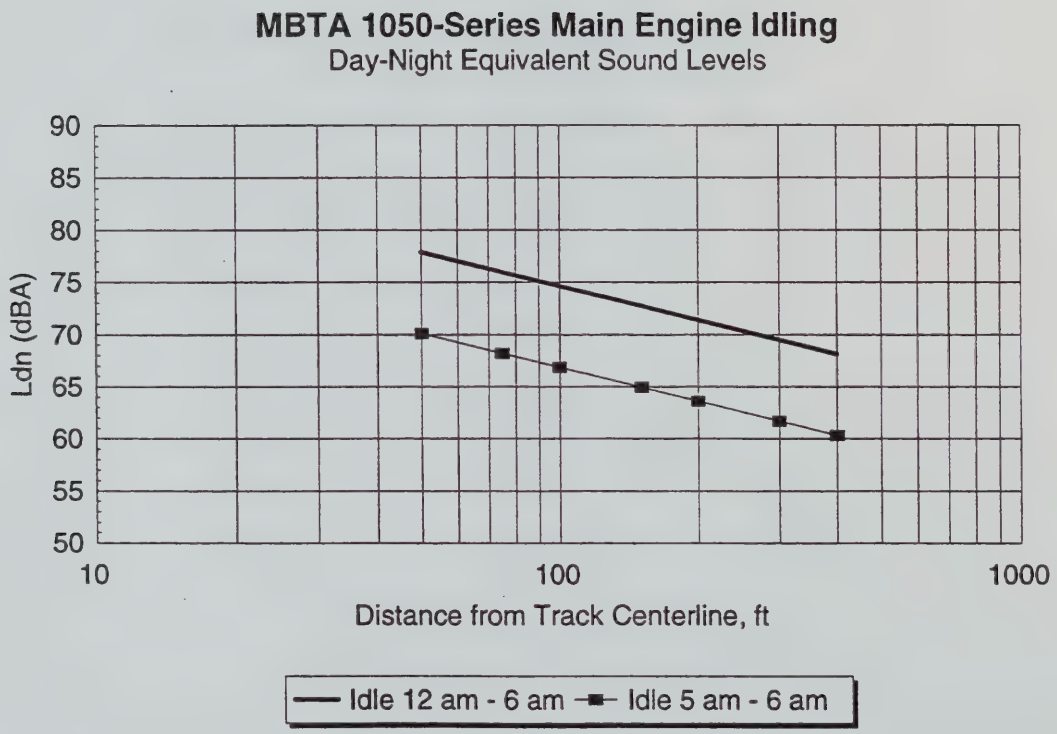
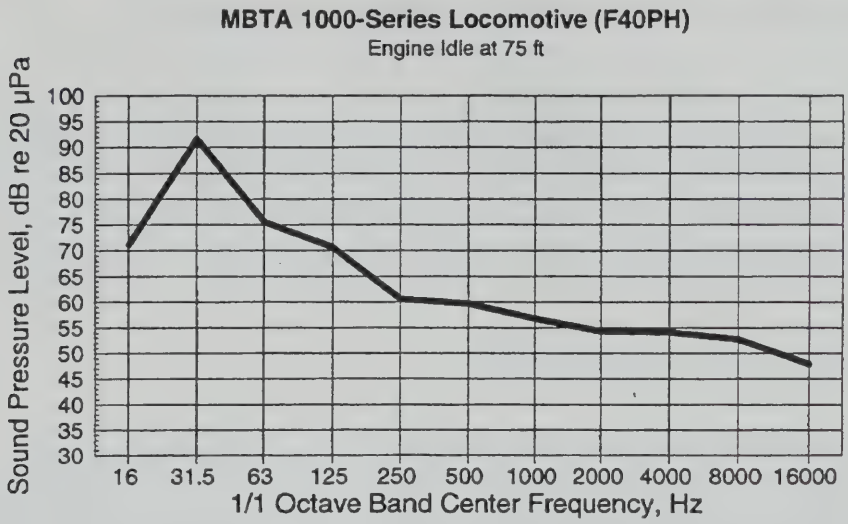


Figure 36. Projected L_{dn} from Layover Facility



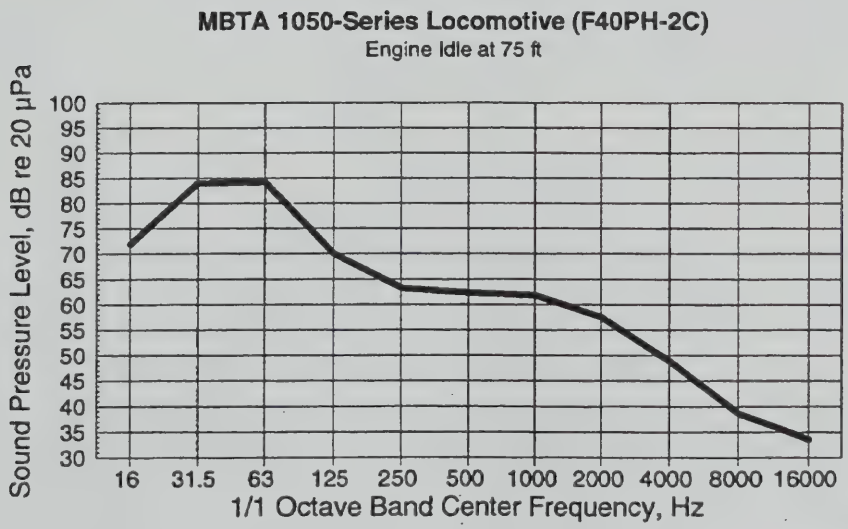


Figure 37. Octave Band Spectra of MBTA Locomotive Idling Noise

6. ASSESSMENT OF TRAFFIC NOISE NEAR STATIONS

The addition of five intermediate stations along the project corridor between Framingham and Worcester have the potential to affect the noise environment in the vicinity of the proposed station sites due to project-induced passenger traffic. Noise impact criteria, projections and assessment for the proposed changes in motor vehicle traffic near commuter rail station sites are described below. Portions of the text from the DEIR are repeated here in order to represent a complete description of the methodology.

6.1 Traffic Noise Impact Criteria

The extent of noise impact from project-generated traffic near stations are based on the projected noise increase relative to the noise from existing traffic near the stations. Because the greatest changes in traffic volumes are expected to occur during peak commuting periods, the noise increase was evaluated in terms of the peak-hour L_{eq}.

According to the existing FTA guidelines on which criteria for traffic noise impact are based (UMTA, 1979), a noise level increase of greater than 5 dBA is considered to represent a significant impact. The existing FTA criteria are used here rather than the proposed new FTA criteria due to the general, non-site specific nature of the traffic noise assessment. This assessment predicts only the change in traffic noise resulting from the projected change in traffic volumes near the stations, and not the absolute traffic noise levels at specific noise-sensitive locations in the community.

6.2 Traffic Noise Impact Assessment

At each station site, the potential for noise impact due to project-generated traffic was evaluated only for streets for which traffic changes are expected to be greatest, and along which noise-sensitive land uses exist. These were primarily existing roads which are proposed for providing passenger access to and from the stations and their parking areas. For such cases the noise impact assessment was carried out on a relative basis, by estimating the change in peak-hour traffic noise along these streets. The change in traffic noise along each affected street was estimated based on the change in peak-hour traffic volume for the build alternative in the year 1995, relative to the existing 1992 traffic volume. With all other conditions equal, the change in peak-hour traffic noise level can be calculated as follows:

$$\textit{Change in Traffic Noise (dBA)} = 10 \log_{10}\left(\frac{V_F}{V_E}\right)$$

where: V_F = 1995 Build traffic volume (vehicles per hour)
V_E = 1992 Existing traffic volume (vehicles per hour)

A summary of the existing and projected future peak-hour traffic volumes on surface streets near each of the five intermediate train stations is provided in Table 11. This table also indicates the predicted change in traffic noise level for each of these streets, based on the expected change in traffic volume. The results indicate that future traffic noise levels in the vicinity of train stations are only expected to range from 0 to 2 dBA above the existing traffic noise levels, not a noticeable difference and well below the 5 dBA criterion.

Table 11. Changes in Traffic Noise near Commuter Stations

TRAIN STATION	ROADWAY NAME	PEAK HOUR	TRAFFIC VOLUME (Vehicles Per Hour)		NOISE LEVEL CHANGE (dBA)
			1992 Existing	1995 Build	Build - Exist
Ashland	Pleasant St	AM	1074	1252	0.7
		PM	1124	1381	0.9
Southborough	Southville Rd	AM	485	518	0.3
		PM	474	497	0.2
Westborough	Smith Valve Parkway	AM	181	269	1.7
		PM	215	239	0.5
Grafton	Westboro Rd	AM	449	514	0.6
		PM	474	495	0.2
Millbury	Worcester Rd (Rt 122)	AM	1803	2156	0.1
		PM	1844	2193	0.8

The proposed layout for one of the stations, Millbury, shows a new access road to be constructed for serving passenger traffic. This street intersects a largely residential area south of the station site. The traffic noise impact assessment for this case was also carried out on a relative basis; however, the existing peak-hour L_{eq} was estimating using measured levels at the Millbury measurement site (Site 3), excluding the contribution from train noise, rather than existing traffic volumes. The future build peak-hour L_{eq} was then estimated using the projected 1995 build traffic volumes, basic roadway geometry and an FHWA-approved traffic noise model (HINAP). This future build level was compared to the existing level and the change was assessed using the same relative criteria.

It was found that for the receivers on President Road near the Millbury Station site, an noise increase of 0 to 2 dBA can be expected as a result of the proposed station access road. Hence, no noise impact was predicted to occur as a result of traffic from this new roadway.

Finally, it should be noted that the above assessment is based on conservative assumptions, and thus it is likely that the actual noise changes near the commuter rail stations will be less than indicated. For example, the projections assume that peak-hour noise levels at locations along the streets near stations are now dominated by the traffic on those streets. Furthermore, the projections assume the same vehicle mix for all cases.

In reality, the peak-hour noise levels may be affected by other community sources such as aircraft overflights and traffic on major highways. In addition, the future build traffic changes consider only an increase in total number of vehicles per hour with the same percentage of trucks as the existing case. While this is a conservative scenario, the increase in station-induced traffic should be largely passenger vehicles (which tend to be quieter than trucks) and would likely be reflected in a lower percentage of trucks. Due to these factors, it is likely that future noise level changes will be less than predicted above.

7. ASSESSMENT OF CONSTRUCTION NOISE

Although construction activities related to the Worcester Commuter Rail Extension Project would be short-term in nature, these activities have the potential to cause noise impact at nearby noise-sensitive locations depending on their intensity and schedule. Noise impact criteria are presented below, followed by an assessment of potential impact from station/layover facility construction, bridge construction, bridge raising and track construction/realignment.

7.1 Construction Noise Impact Criteria

Noise impact criteria for construction are based on the outdoor Annual Average Day-Night Equivalent Sound Level (AA L_{dn}), with a threshold of 65 dBA AA L_{dn} defining the noise impact zone. As stated previously, the L_{dn} is a 24-hour, energy-average noise level with a 10 dB penalty applied to noise occurring at night (10 pm to 7 am). The L_{dn} is considered appropriate because some nighttime construction activity is anticipated and because it is the noise metric adopted for the assessment of project train noise impact. For construction noise, the daily phase L_{dn}s are averaged over a one-year period based on durations and schedules to determine the AA L_{dn} at nearby noise-sensitive receivers.

7.2 Construction Noise Impact Assessment

All potential noise impact from project construction is expected to be site-specific and temporary, with no long-term construction activity planned for longer than a 12 month duration. Only those in the immediate vicinity of a bridge, station or section of track under repair of modification will experience the noise impact. Such impacts will be localized and will vary during the course of the construction as different facilities are improved at different locations. The actual duration of activity at a specific location will be relatively short (two to four weeks along track sections be realigned) except where major construction, e.g. bridges and stations, will be required. In such cases, construction-related noise may be experienced for period of several months to a year.

Despite the transient nature of construction, the noise impact from these activities may be significant due to the high noise levels generated by individual pieces of construction equipment. In addition, the possibility of nighttime construction work to minimize disruption of current train operations will add further to the noise impact. Since background ambient noise levels are lower during these hours, a noise level of a given intensity would be perceived as louder during the nighttime than during the daytime hours. Certain trackwork operations, such as undercutting, and various phases of major construction efforts may occur during the evening and nighttime hours.

7.2.1 Station Construction

The construction of fixed facilities (i.e. stations and layover facility) is expected to include clearing, excavation, foundation work, equipment installation, paving and finishing. Construction machinery is likely to include the types of equipment typically used for light industrial construction, such as graders, bulldozers, backhoes, cranes and trucks. Construction will typically occur during 8 to 10 hour weekday, daytime periods.

Construction of a typical station was divided into two sources: parking area construction and platform area construction (tracks, platforms, ramps and overpasses). The total duration of station construction was assumed to be 8 months, with about 12 months required for layover facility construction. Station construction noise exposure was estimated using equipment noise levels and scenarios that are typical for non-residential construction (EPA, 1971), as well as specific duration and task information provided by E&K. Usage factors were assigned to each piece of equipment to determine a cumulative reference noise level to use in determining the width of the noise impact zone.

Equipment rosters for both parking lot and platform area construction are provided in Tables 12 and 13, respectively, along with full-power equipment noise emission levels at a reference distance of 50 feet, assumed utilization factors or duty cycles (i.e. the percentage of time during operating hours that the equipment operates under full power during each phase), and the resulting workday L_{eq} and annual average L_{dn} for each phase.

For construction of the layover facility, similar equipment roster and duty cycles were assumed, with a slightly longer duration of 12 months. This resulted in a total AA L_{dn} of 79 dBA at 50 ft.

The impact zone for station construction was determined by evaluating noise levels at sensitive receivers based on the AA L_{dn} at 50 ft; then, assuming the minimum sound attenuation rate, with noise levels decreasing by 6 decibels for each doubling of distance from the respective centers of construction (20*log*[distance]), the screening distance to an AA L_{dn} of 65 dBA was projected. For parking lot construction, this distance was estimated to be 130 ft, while the screening distance for platform area construction was found to be 160 ft. For the layover facility, these distances were estimated to be 160 ft and 200 ft, respectively. To be conservative, all distances are measured from the closest area of construction. They represent the maximum distances from the construction operations where noise impact is projected to occur for residences with an unobstructed view of the construction activities.

Table 12. Noise Projections for Station Construction - Parking Lot Area

CONSTRUCTION ACTIVITY	CONSTRUCTION EQUIPMENT	EQUIPMENT NOISE LEVEL @ 50' (dBA)	ACTIVITY DURATION (Weeks)	EQUIP. USAGE (%)	PHASE AVG. WORKDAY Leq @ 50' (dBA)
Tree Clearing	Chain Saw	90	1	30	69
Stump Removal	Backhoe	85	1	4	56
Excavation/Earthwork	Bulldozer	80	3	40	65
Rough Grading	Compactor	80	1	40	61
	Dozer	80	1	40	61
Install Gravel Base	Dump Truck	88	1	40	69
	Dozer	80	1	40	61
Compact Base	Compactor	80	1	40	61
	Dozer	80	1	40	61
Install Utilities	Backhoe	85	7	16	70
	Trucks	88	7	32	76
Saw Cut/Match Existing Pavement	Saw	90	1	8	64
	Backhoe	85	1	16	62
Fine Grading and Compaction	Truck	88	1	40	69
	Grader	85	1	20	63
	Compactor	80	1	40	61
Paving	Paver	89	1	50	71
	Roller	80	1	50	62
Install Curbing	Truck	88	2	32	71
	Backhoe	85	2	16	65
Install Amenities (Light Poles, etc.)	Truck	88	2	32	71
	Backhoe	85	2	16	65
AVERAGE WORKDAY Leq FOR CONSTRUCTION PHASE AT 50 FT:					81
AVERAGE WORKDAY Ldn FOR CONSTRUCTION PHASE AT 50 FT:					76
ANNUAL AVERAGE Ldn FOR CONSTRUCTION PHASE AT 50 FT:					73

Table 13. Noise Projections for Station Construction - Platform Area

CONSTRUCTION ACTIVITY	CONSTRUCTION EQUIPMENT	EQUIPMENT NOISE LEVEL @ 50' (dBA)	ACTIVITY DURATION (Weeks)	EQUIP. USAGE (%)	PHASE AVG. WORKDAY Leq @ 50' (dBA)
Install New Ballast	Equalizer	82	4	30	67
	Tamper	83	4	30	68
Install New Ties	Tie Cutter	84	4	30	69
	Handler	80	4	30	65
	Inserter	85	4	30	70
Install New Tracks	Spike Driver	77	4	30	62
Install Switches, Signals, etc.	Truck	88	4	10	69
Trench Excavation for Footings	Backhoe	85	2	16	65
	Truck	88	2	40	72
Rock Excavation	Ripper	98	2	4	72
Install Gravel Base and Compact	Dump Truck	88	1	40	69
	Compactor	80	1	40	61
Formwork and Steel Reinforcing	Truck	88	3	40	73
Place Concrete	Concrete Mixer	85	2	40	69
	Vibrator	76	2	10	54
Install Precast Platform Panels	Crane	83	2	32	66
Install Pedestrian Overpass/Bridge	Crane	83	8	32	72
	Air Compressor	81	8	200	78
Install Amenities (Canopy, etc.)	Truck	88	4	16	71
	Air Compressor	81	4	80	71
	Impact Wrench	85	4	5	63
AVERAGE WORKDAY Leq FOR CONSTRUCTION PHASE AT 50 FT:					83
AVERAGE WORKDAY Ldn FOR CONSTRUCTION PHASE AT 50 FT:					79
ANNUAL AVERAGE Ldn FOR CONSTRUCTION PHASE AT 50 FT:					75

7.2.2 Bridge Construction/Modifications

The project will be require the construction of a new bridge at Pine Street in Grafton (MP 36.4) and the re-construction of the existing Route 85 bridge in Southborough (MP 27.4). In addition, the three following existing bridges will be raised: 1) Fountain St, Ashland (MP 23.7), 2) Bridge St, Southborough (MP 28.0), and 3) Hamilton St, Worcester (MP 41.67).

Equipment for bridge work will include cranes, trucks, jacks, material-handling equipment and other heavy-duty construction equipment. Depending on foundation requirements, pile driving may also be required for the bridge construction/replacement. This work is expected to be carried out during normal daylight hours, with an approximate duration of 3 to 9 months per bridge.

Construction noise exposure for the modifications at bridges was estimated based on noise projections for this activity that were made during the Programmatic Environmental Impact Study (PEIS) for the Northeast Corridor Improvement Project (FRA, 1978). Based on this study, the AA L_{dn} at 50 ft were taken to be 87 dBA for bridge construction or replacement, and 77 dBA for bridge raising.

To obtain screening distances for noise impact assessment, point-source sound attenuation was assumed for bridge work. Based on the noise levels at 50 ft, the distances to the 65 dBA AA L_{dn} impact criterion were estimated to be 630 ft for bridge construction, and 200 ft for bridge raising.

7.2.3 Right-of-Way Construction

Project right-of-way construction would consist of (1) construction of additional mainline track from MP 33 to 40, (2) reconstruction of the existing mainline track from MP 40 to 44, and (3) lowering tracks to accommodate vertical clearance requirements, or undercutting.

Primary activities include tie renewal, ballast cleaning and undercutting, installation of continuously welded rail and rail surfacing and grinding. Each of these operations involves one or more pieces of specialized rail maintenance equipment which moves relatively continuously along the track. Since the majority of the work requires machinery to operate directly on the track bed, some of this construction is anticipated to occur at night to avoid disruption of daily operations. The duration of nighttime construction would be dictated mainly by Conrail, since most nighttime train operations are Conrail freight trains.

Estimates of noise levels from track construction and undercutting were also made based on the maximum trackwork noise levels taken from the Northeast Corridor PEIS. This resulted in an AA L_{dn}

of 75 dBA for daytime operation and 85 dBA for nighttime operation. Assuming line source sound propagation (3 dB attenuation for each doubling of distance) for trackwork, noise impact screening distances to the criterion of 65 dBA AA L_{dn} were found to be 15 ft and 20 ft for daytime and nighttime operations, respectively. In all cases, no potential for significant impact was found to exist from trackwork construction

8. ASSESSMENT OF TRAIN VIBRATION

Steel-wheeled trains operating on steel rails create vibration energy that propagates through the intervening soil and rock layers to nearby buildings. Once the vibration waves propagate through a building, the vibration may be perceived by occupants as motion of building surfaces, rattling of items on shelves or hanging on walls, or as a low-frequency rumbling noise. The rumble is caused by the vibrating walls, floors and ceiling radiating acoustic waves. In a sense, the room surfaces act like giant loud speakers. Although it is very rare, there is some potential for train-induced ground vibration to cause building damage, particularly when trains will operate very close to fragile historic buildings. In this study, however, no potential for building damage from train-induced vibration was identified.

One of the major problems with developing accurate estimates of ground-borne vibration is the large number of factors that can influence the levels at a given receiver position. The physical parameters of the transit facility, the area geology and the receiving building all can have an influence on the vibration levels. Unlike airborne noise, characteristics of both the path and receiver of ground-borne vibration are highly variable and difficult to predict. The important physical parameters can be divided into the following four categories:

Operational Factors: This category includes all of the parameters that relate to the track system and vehicle. Factors such as high train speeds, stiff primary suspensions on the vehicle, stiff track support systems, jointed rail, flat or worn wheels, or corrugated rail will increase the possibility of vibration-related problems.

Guideway: The type of guideway, the rail support system, and the mass and stiffness of the guideway structure will all have an influence on the level of ground-borne vibration. A rail system guideway will be either subway, at-grade, or elevated. It is rare for ground vibration to be a problem with elevated railways except for buildings located within 50 ft of guideway supports; directly radiated noise is usually the predominant problem from at-grade guideway although vibration **can** be a problem; and ground-borne vibration is often one of the most important environmental problems for subways.

Geology: Soil conditions are known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock. Experience with ground-borne vibration is that vibration propagation is more efficient in stiff clay soils, and shallow rock seems to concentrate the vibration energy close to the surface and can result in ground-borne vibration problems at large distances from the track. Factors such as layering of the soil and depth to water table are expected to have significant effects on the propagation of ground-borne vibration.

Receiving Building: The receiving building is a key component in the evaluation of ground-borne vibration since ground-borne vibration problems occur almost exclusively inside buildings. The vibration levels inside a building are dependent on the vibration energy that reaches the building foundation, the coupling of the building foundation to the soil, and the propagation of the vibration through the building. A general guideline is that the heavier a building is, the lower the response will be to the incident vibration energy.

8.1 Train Vibration Source and Propagation Measurements

As described in Chapter 3, ground-borne vibration levels from trains currently operating on the corridor between Framingham and Worcester were measured at a location in Westborough to characterize the existing conditions. In addition, vibration measurements at Site 9 in Natick were conducted concurrently with the source noise measurements described in Chapter 4. These data were used to define the baseline conditions for the future project scenario.

The vibration data at Site 9 also apply to all train passages for which noise data were also collected. As with the vibration measurements conducted in Westborough, four accelerometers were used simultaneously at increasing distances from the track for each train event. Identical data acquisition and analysis equipment were used for both Sites 5 and 9. Table 14 below provides a summary listing of the vibration levels measured at both sites for each train passage monitored (identical to those reported in Table 6 for noise).

Table 14. Summary of Train Vibration Source Measurement Data

SITE	DATE	TRAIN DESCRIPTION			DIST. TO TRACK CENTERLINE (ft)	SPEED (mph)	Maximum RMS Vibration Velocity Level (V_{ml} re 1 μinch/sec)	
		Type	#Loco	#Cars			Loco.	Rail Cars
5	4-29-93	Amtrak	1	2	25	45	86.3	--
					50		84.5	--
					75		82.3	--
					100		80.5	--
			1	10	25	68	88.4	--
					50		87.0	--
					75		83.5	--
					100		81.1	--
			1	3	25	46	84.5	--
					50		83.0	--
					75		80.9	--
					100		78.7	--
		Conrail	1	9	25	40	96.9	85.8
					50		86.8	82.3
					75		90.0	81.2
					100		85.9	78.7
			4	88	25	40	97.3	90.5
					50		94.5	87.5
					75		91.0	86.5
					100		88.3	81.5
			1	0	25	40	79.7	--
					50		78.0	--
					75		76.5	--
					100		75.3	--
9	4-30-93	Amtrak	2	9	25	60	85.7	--
					50		84.6	--
					75		80.1	--
					100		79.5	--
			2	9	38	67	81.9	--
					63		81.7	--
					88		78.4	--
					113		77.3	--
		MBTA	1	6	25	65	85.4	--
					50		84.0	--
					75		79.7	--
					100		79.3	--
9	4-30-93	MBTA	1	6	38	65	86.4	--
					63		84.3	--
					88		80.5	--
					113		79.6	--
			1	7	25	52	83.3	--
					50		81.3	--
					75		77.3	--
					100		76.6	--
			1	7	38	49	79.9	--
					63		79.9	--
					88		75.5	--
					113		73.5	--
			1	7	25	53	83.5	--
					50		82.5	--
					75		78.3	--
					100		78.1	--
			1	6	25	60	87.5	--
					50		84.4	--
					75		79.5	--
					100		79.0	--

8.2 Train Vibration Projection Model

Because ground-borne vibration is a complex phenomenon that is difficult to model and predict accurately, most projection procedures used for rail projects rely on empirical data. This section summarizes the empirical method used to develop a model of vibration generated by trains operating on the project corridor. The model is based on available data from measurements and provides a relatively conservative, reasonable basis for projecting train vibration along the corridor for existing and future scenarios.

It was found that with the exception of Conrail locomotives, which generated the highest ground-borne vibration levels, vibration from the three different train types--Amtrak, MBTA and Conrail--are about the same magnitude at their respective maximum speeds. Figure 30 illustrates this in the form of regression curves of vibration level as a function of distance for each type of train equipment that will be operating on the project corridor, at their future maximum allowable speeds. Note that these speeds are 10 mph higher than current operating conditions allow.

Because the ground-borne vibration generated by MBTA trains is not likely to exceed levels that nearby residents are currently exposed to, annoyance associated with the project-generated vibration will probably be related more to the increase in *number* of vibration events per day, rather than higher levels. Despite this observation, the vibration created by MBTA commuter trains was assessed independently on an absolute scale (as described in Chapter 2). This type of approach ensures that the method of determining impact does not unfairly penalize those who are already exposed to high vibration levels.

Figure 38 shows only the projected levels associated with Conrail freight cars, and excludes the curve obtained from the locomotive data. Since most Conrail freight trains are typically much longer than passenger trains and often consist of 30 or more freight cars hauled by only a few locomotives, the vibration generated by freight trains was assumed to be dominated by the freight cars. This assumption ensures a relatively conservative assessment by not overestimating the vibration created by existing freight traffic. In the case of Amtrak and MBTA trains, because of the shorter train consists it is reasonable to assume that the highest overall vibration level characterizes each event.

The curves in Figure 38 apply to trains at a single speed, and were used to project maximum Existing, Basic Service and Full Service vibration levels along each segment in the project corridor. The following adjustment for speed was applied to account for variations in operating speed:

$$\Delta L = 20 \log_{10}\left(\frac{v}{v_{ref}}\right)$$

where: v = train speed, in mph
$v_{re,}$ = reference train speed, in mph

As is the case for noise, special trackwork can cause ground-borne vibration increases of 5 to 10 dB close to the track. However, because their effects are highly localized and because the project will not alter their locations, a detailed analysis of special trackwork is not required for a reasonable assessment of vibration impact.

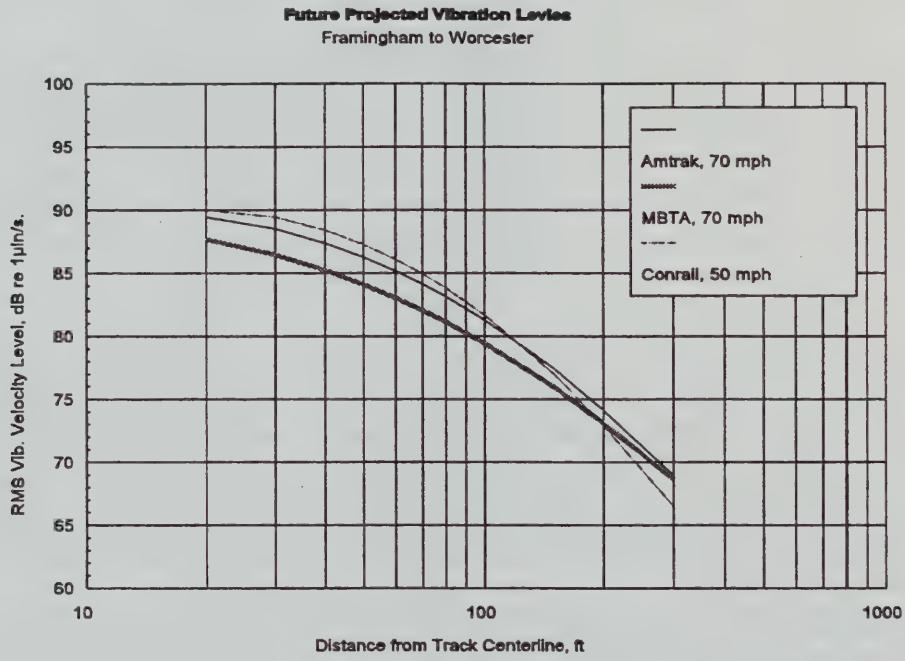


Figure 38. Future Projected Train Vibration Levels

8.3 Train Vibration Impact Assessment

The speed-corrected vibration propagation curve for each segment of the project corridor was used to determine impact screening distances within which impact from vibration is likely to occur. These distances were obtained by comparing the results of the vibration projection model with project criteria along individual segments of the corridor. These distances are given by corridor milepost segment below in Table 15.

The absolute criterion for vibration generated by MBTA commuter train service was selected based on the total number of existing train operations per day and the criteria described in Chapter 2. In all cases, a criterion of 80 V_{dB} was found to apply, since the number of trains per day will not exceed 70.

For higher levels generated by Conrail and Amtrak trains associated with increases in allowable maximum speeds, the relative criterion of 2 V_{dB} or more increase in the vibration level associated with each was applied.

Table 15. Vibration Impact Screening Distances by Milepost Segment

SEGMENT	CITY/TOWN	MILEPOST		Distance to Vibration Impact (ft)	# Residences in Impact Zone
		From	To		
Fountain St	Framingham	21.5	21.9	23	0
Winter St	Framingham	21.9	22.4	44	0
Ashland Line	Framingham	22.4	22.8	61	3
Fountain St	Ashland	22.8	23.7	71	0
Sudbury River	Ashland	23.7	23.8	78	0
Main/Cherry GXs	Ashland	23.8	24.7	84	15
	Ashland	24.7	25.3	86	0
Ashland Sta	Ashland	24.9	25.7	78	0
High St	Ashland	25.0	25.9	23	0
ASHLAND STATION	Ashland	25.3	26.0	1	0
	Ashland	26.0	26.3	23	0
Southboro Line	Ashland	26.3	26.4	24	0
	Southboro	26.4	26.9	53	0
River St/Rt 85	Southboro	26.9	27.3	61	0
Southboro Sta	Southboro	27.3	27.4	65	0
	Southboro	27.4	27.5	23	0
Bridge St	Southboro	27.4	28.0	23	0
Westboro Line	Southboro	28.0	28.5	53	1
Fruit St	Westboro	28.5	28.9	61	0
I-495	Westboro	28.9	29.5	70	0
Conrail Yard	Westboro	29.5	30.1	93	0
Rt 30	Westboro	30.1	32.0	93	0
Milk St/Rt 135	Westboro	32.0	32.7	93	3
	Westboro	32.7	33.0	93	0
Maynard St br	Westboro	33.0	33.2	93	1
Otis St	Westboro	33.2	33.6	23	0
Westboro Sta	Westboro	33.6	33.9	23	0
Arch St	Westboro	33.9	34.7	53	0
	Westboro	34.7	35.2	61	0
Grafton Line	Westboro	35.2	35.8	70	0
Tufts Univ	Grafton	35.8	36.2	75	0
Pine St	Grafton	36.2	36.4	44	0
Grafton Sta	Grafton	36.4	36.5	1	0
	Grafton	36.5	36.9	44	0
Grafton GX	Grafton	36.9	37.2	61	2
	Grafton	37.2	37.5	78	0
Rt 140	Grafton	37.5	38.0	93	8
Millbury Line	Grafton	38.0	39.0	93	0
	Millbury	39.0	39.4	78	0
	Millbury	39.4	39.5	61	1
Millbury Sta	Millbury	39.5	39.6	23	0
Rt 20	Worcester	39.6	39.9	23	0
Sunderland Rd	Worcester	39.9	40.2	34	0
Lake Park/Coburn	Worcester	40.2	41.5	61	1
Hamilton St	Worcester	41.5	41.7	44	0
	Worcester	41.7	42.3	44	0
Eastview Rd	Worcester	42.3	42.4	44	0
(Eastview Apts)	Worcester	42.4	42.6	44	4
Plantation St	Worcester	42.6	42.8	44	0
Draper St	Worcester	42.8	43.2	44	2
Putnam St	Worcester	43.2	43.9	44	0
	Worcester	43.9	44.1	1	0
	Worcester	44.1	44.2	1	0
Worcester Sta	Worcester	44.2	44.3	1	0

9. ASSESSMENT OF CONSTRUCTION VIBRATION

Ground-borne vibration from construction activities related to the project have the potential to affect nearby structures and their occupants. The potential for impact is greatest for intense construction activities, such as blasting and pile driving. A description of the methodology used in assessing potential vibration impact from the proposed construction tasks are presented in this section.

9.1 Construction Vibration Projections

Ground-borne vibration from construction was estimated based on equipment source data in the literature (Wiss, 1974; FHWA, 1982; FTA, 1990) and empirical data on propagation characteristics of point sources along the ground surface. Vibration projections were made for three construction equipment categories, based on the relative amount of energy imparted to the ground as follows:

1. Light-duty equipment: This category includes equipment that is expected to be used for trackwork, including undercutters, small earth-moving equipment and specialized rail maintenance equipment. A vibration velocity level of 70 V_{dB} at 25 ft has been chosen as the source level for these types of equipment and activities.

2. Heavy-duty equipment: This category includes heavy trucks and large earth-moving equipment that are expected to be used for layover and station construction, bridge raising and bridge replacement. A vibration velocity level of 85 V_{dB} at 25 ft has been chosen as the source level for these types of equipment and activities.

3. Pile-driving equipment: A vibration velocity level of 100 V_{dB} at 25 ft has been chosen as the source level for impact pile driving equipment that may need to be used during bridge construction.

The above source levels cover the range of ground vibration likely to be generated during project construction. If blasting is not required for any phase of the construction, pile drivers represent the greatest potential source of construction vibration impact.

Estimates of construction vibration propagation at distances other than 25 ft were made based on ground vibration propagation data measured along various other rail corridors. These measurements indicated vibration attenuations of 6 V_{dB} per distance doubling within 50 ft, 9 V_{dB} per distance doubling between 50 ft and 100 ft, and 12 V_{dB} per distance doubling beyond 100 ft.

9.2 Construction Vibration Impact Assessment

To obtain screening distances for construction vibration impact assessment, the method described above was used to project vibration levels as a function of distance for each type of construction activity. Then, the distances to the various impact criterion levels were determined. The resulting vibration impact screening distances are given in Table 16. With the aid of aerial photographs of the project corridor, an inventory of vibration-sensitive land use within the screening distances was performed to assess potential vibration impact from the proposed construction activities.

Table 16. Construction Vibration Impact Screening Distances

General Types of Construction Activities	APPROXIMATE DISTANCE FOR VIBRATION IMPACT (ft)				
	BUILDING DAMAGE		BUILDING OCCUPANT ANNOYANCE		
	General (100 V_{dB})	Fragile (95 V_{dB})	Cat. 3 (75 V_{dB})	Cat. 2 (72 V_{dB})	Cat. 1 (65 V_{dB})
Track installation & undercutting	--	--	15	20	45
Facility Construction & Bridge Raising or Replacement	--	--	70	85	135
Pile Driving for Bridge Construction or Replacement	25	45	180	210	320

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SECTION 4.0

ARCHAEOLOGICAL SURVEY

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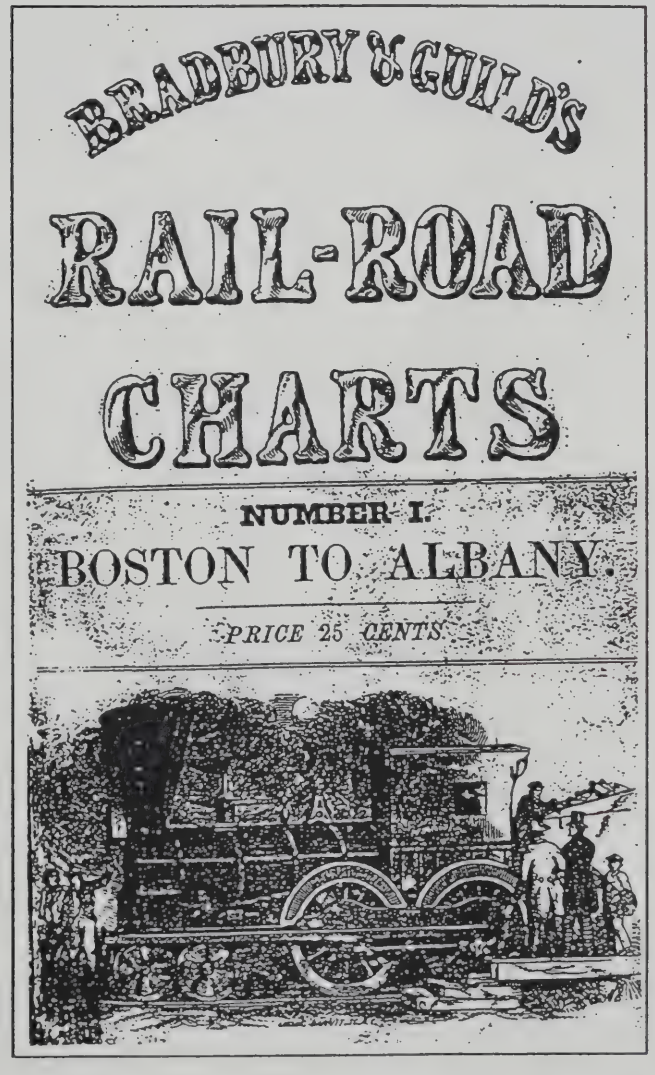

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ARCHAEOLOGICAL RECONNAISSANCE SURVEY

FOR THE

WORCESTER COMMUTER RAIL EXTENSION

FRAMINGHAM, ASHLAND, SOUTHBOROUGH WESTBOROUGH, GRAFTON, MILLBURY, AND WORCESTER, MASSACHUSETTS

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October 8, 1993

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I. PROJECT DESCRIPTION

The Massachusetts Bay Transportation Authority (MBTA) intends to initiate commuter rail service between Worcester and Framingham, as an extension of the existing service between Boston and Framingham. This commuter service will use the existing Conrail track between Worcester and Framingham, which passes through Worcester, Millbury, Grafton, Westborough, Southborough, Ashland, and Framingham (Fig. I-1). The existing track was first laid in the 1830s, at which time there was considerable impact to existing archaeological (prehistoric and historic) sites. Since that time, additional historic structures have appeared along the rail line.

Since the Worcester Commuter Rail Extension (WCRE) project intends to use the existing Conrail roadbed, the construction impacts along most of the rail corridor will be minimal. However, several components of the project do involve potential impacts to the cultural resources of the rail corridor, as follows:

1. A second track will be re-laid along 11 miles of the existing rail bed between Westborough and Worcester. Conrail's requirement of a 14-foot distance between the centerlines of track on the same rail bed implies that the rail embankment will be widened in some places, resulting in disturbances on at least one side of the embankment in affected areas. The precise location and extent of these new disturbances will be identified during the final design of the project, in negotiation with Conrail.

2. Five new stations will be constructed, in Ashland, Southborough, Westborough, Grafton, and Millbury. The location of the proposed Millbury station has not been determined, and two possible sites are now under consideration. The station constructions involve the station buildings themselves, parking lots, and access roads, as well as up-grades of the track in the station areas. Since these stations are to be new construction, they will impact lands previously unaffected by the existing rail line.

3. Chain-link fencing will be erected along certain portions of the rail corridor that have been judged critical to safety and security. At the same time, the need to allow wildlife crossing limits the extent of this fencing. The construction of fences involves fairly narrow bands of disturbance at the edges of the existing rail line, and potentially will expand the zone of existing disturbance. The precise location of the fencing will be identified in the final design of the project.

4. Several geometrically inadequate bridges will be reconfigured, namely those at Pine Street in Grafton and at Route 85 in Southborough; in addition, other bridges and some existing culverts may need repair.

5. Traffic signals will be up-graded.

These components of the WCRE project may cause additional disturbance to pre-rail prehistoric and historic archaeological sites, and new impacts to subsequently formed historic archeological sites. The proposed station sites have the potential to produce significant changes in the setting and feeling of historic properties. And construction, including the reconstruction or replacement of bridges, and the taking of buildings for station construction, will dramatically impact the relevant structures.

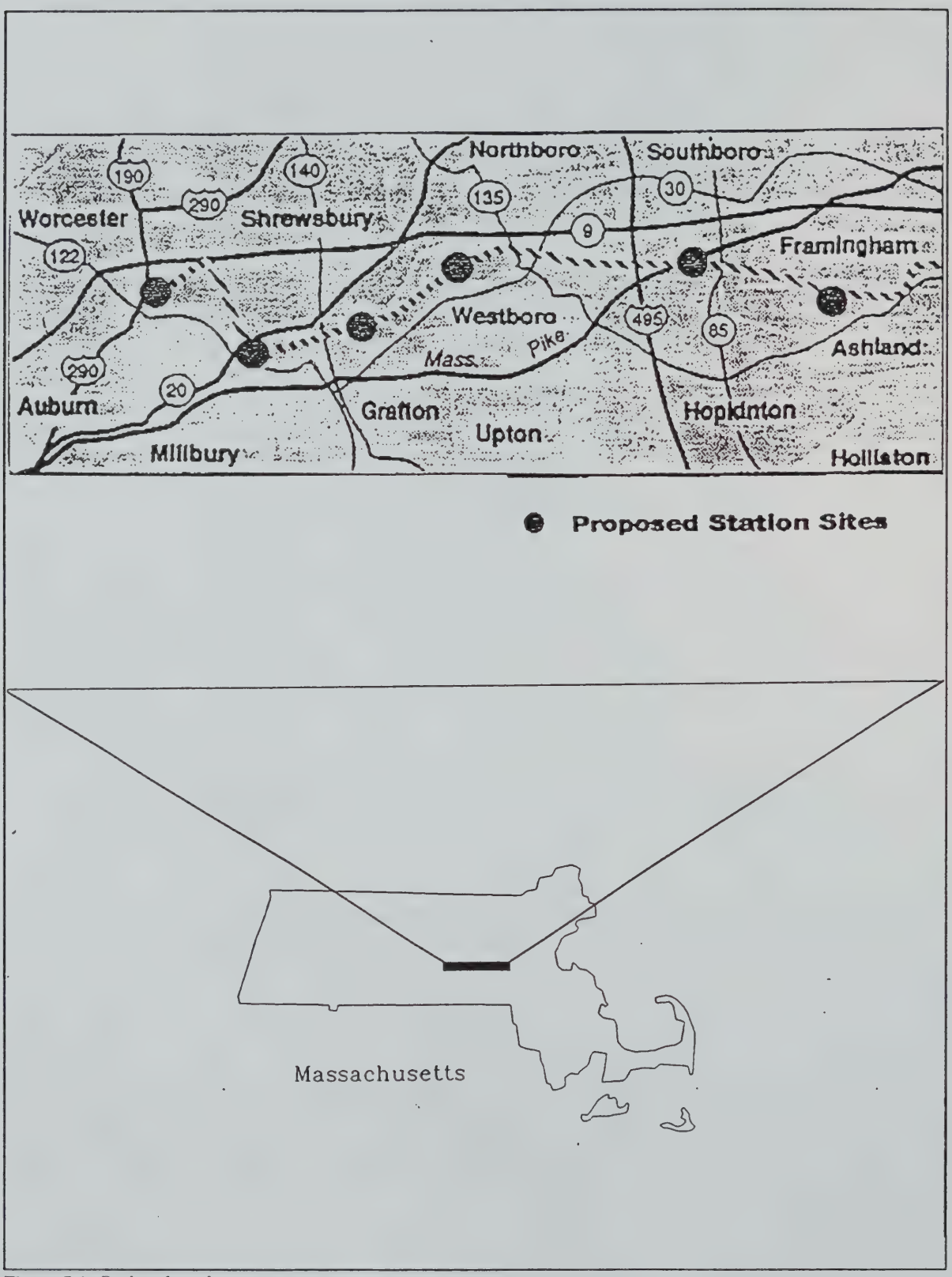


Figure I-1 Project location.

In order to address these potential impacts, the Massachusetts Historical Commission required the MBTA to conduct a reconnaissance-level cultural-resource survey of the rail corridor as part of the project's environmental impact study. The MBTA subcontracted with Timelines, Inc., of Groton, MA, to undertake the reconnaissance survey, which was authorized under State Archaeologist's Permit No. 1294.

Timelines' reconnaissance survey contained several distinct components. A literature search identified known prehistoric and historic sites in and near the rail corridor, and established a context within which to assess the significance of the known and potential archaeological sites and standing architecture along the rail corridor. A "windshield survey" of standing architecture, conducted by Jane Carolan and Joyce Clements in February and March, 1993, assessed the style, condition, and historic context of approximately 850 buildings along the rail corridor. A walkover survey of the rail corridor, conducted by Elena Décima, Chris Edens, and Leith Smith in early June, 1993, had two main goals: to identify archaeological (prehistoric and historic) resources exposed on the surface of the rail corridor, and to gain information useful in modeling the probability that subsurface archaeological resources exist in the rail corridor. Predictive models used the background research and walkover results to identify the archaeological sensitivity (high, moderate, or low probability of containing archaeological sites) of segments along the rail corridor.

This document, which reports the results of the background research, the architectural windshield survey, the archaeological walkover survey, and the predictive modeling, is intended to serve two functions:

1. To provide the MBTA with cultural-resource-management information that will clarify the costs and benefits of final design decisions;

2. To provide the MHC with information and recommendations about options for the mitigation of impacts to known and potential cultural resources.

The following report of Timelines' reconnaissance work will first present three chapters of background information on the environment, prehistory, and history of the rail corridor. The reconnaissance field study will then be described. The two next chapters will review the rationale, assumptions, and methods of modeling expectations of archaeological sensitivity along the rail corridor, for both the Prehistoric and the Historic period. The last two chapters will present the results of the sensitivity modeling, and will make recommendations about the need for future archaeological work in the project impact areas along the rail corridor.

II. ENVIRONMENTAL BACKGROUND

A. Present Conditions

1. *Physiography*

The rail corridor drops from around 150 m. above sea level (a.s.l.) to about 50 m. a.s.l. as it moves from Worcester to Framingham. The design requirements of railroads are such that the changes in altitude over the 23-mile length of the corridor must be gradual, accomplished in part by combinations of cuts into hill slopes, and elevated ballast embankments. In fact, the rail corridor traverses several distinct land forms between Worcester and Framingham. At the broadest scale, the corridor crosses from the New England Uplands (above 100 m. a.s.l.) into the Seaboard Lowlands (below 100 m. a.s.l.), in Fenneman's (1938) classification. The maximum altitude of hills near the rail corridor reflects this basic distinction of physiographic provinces: over 200 m. a.s.l. in Worcester and Grafton, and dropping to 180-130 m. a.s.l. further east in Southborough and Framingham.

This broad scheme of physiographic categories glosses over important local variations in land form (see Stone and Peper 1982) (Fig. II-1). The city of Worcester sits at the edge of the Worcester Front, a distinct but gentle escarpment that rises from 200 to 250 m. a.s.l., separating the coastal lowlands on the east from the Worcester County Plateau (an upland with moderate relief, generally 300-350 m. a.s.l.) on the west. Several upland zones occur east of the Worcester Front, including the Rhode Island Gneiss Upland, through which the rail corridor runs. This upland, which is defined by the 200-m. contour, is heavily dissected with moderate to low relief.

2. *Surface Water*

The WCRE corridor cross two major drainages, the south-flowing Blackstone River and the east-flowing Merrimack River. The Quinsigamond River is a major tributary of the Blackstone River, flowing from Lake Quinsigamond through Hovey Pond, Flint Pond, and Lake Ripple to its confluence with the Blackstone in Sutton. These ponds are at least partially artificial, created by industrial damming during the nineteenth century; prior to damming, wetlands probably occupied these portions of the river. The WCRE corridor crosses the Quinsigamond River between Flint and Hovey Ponds in Grafton. The rail corridor also crosses several small streams that flow into the river. These crossings, all in Grafton, include the left-bank tributaries Big Bummet Brook and Summit Brook, the wetland headwaters of Axtell Brook, and several unnamed right-bank tributaries.

The WCRE corridor crosses two distinct portions of the Merrimack drainage, the Assabet and Sudbury rivers, which flow northeasterly before meeting to form the Concord River. The wetlands contained by the George H. Nichols Dam in Westborough form the headwaters of the Assabet River. Hocomonco Pond, several hundred meters north of these wetlands, lets out through wetlands into the same drainage. The rail corridor passes between the ponded wetland and Hocomonco Pond, and crosses several tributary streams west of the ponded wetland. The Sudbury River rises from Cedar Swamp in Westborough, flowing eastward through Westborough, Southborough, and Ashland before turning northward in Framingham. The river has several important tributaries between Cedar Swamp and Framingham, including Indian Brook and Cold Spring Brook in Ashland, and several other unnamed streams in Southborough and Ashland. The river itself was dammed at many points to provide power for nineteenth-century industry and to feed Metropolitan Boston's water supply. The rail

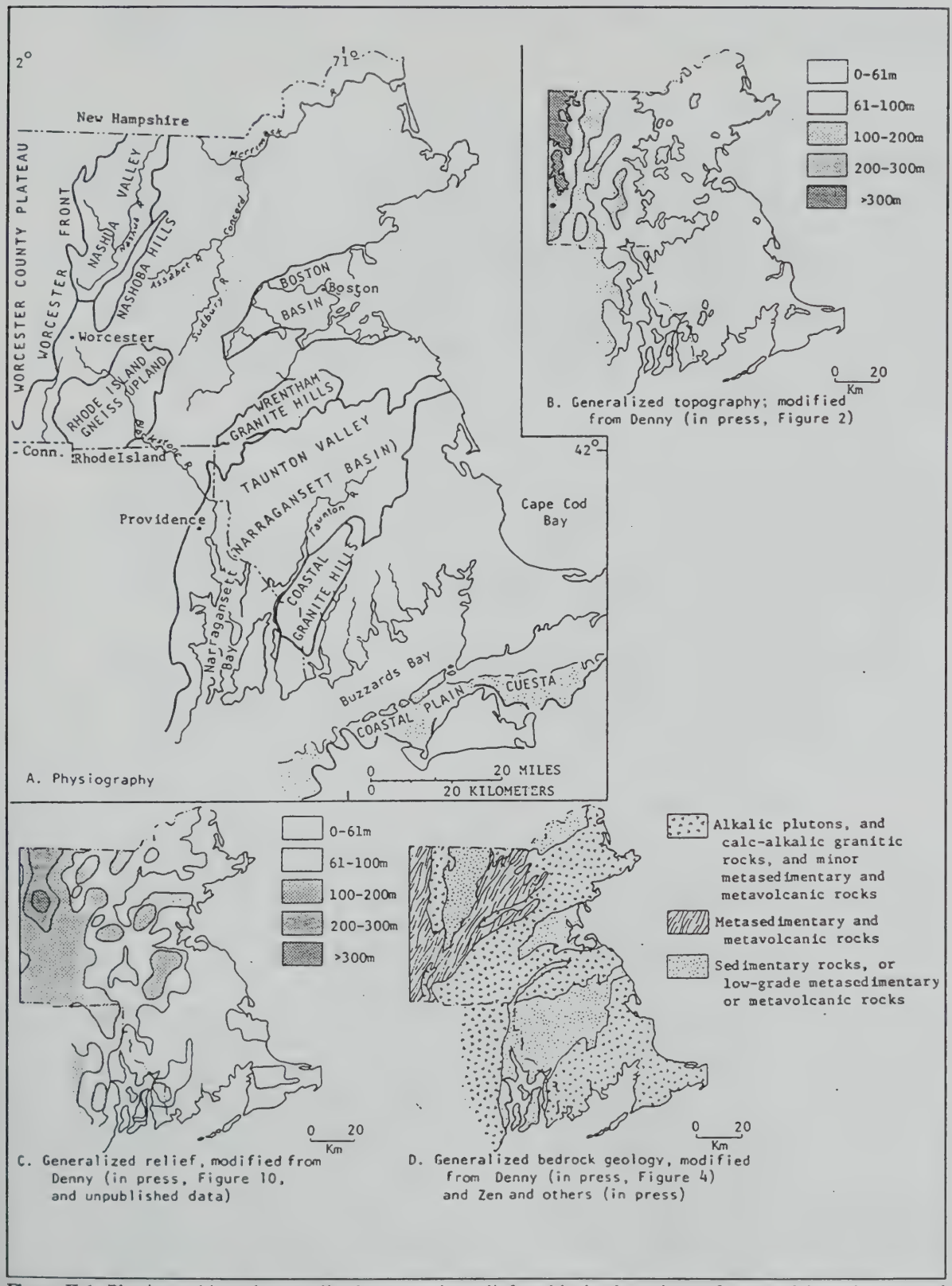


Figure II-1 Physiographic and generalized topography, relief, and bedrock geology of eastern Massachusetts and eastern Rhode Island (Stone & Peper, 1982).

corridor passes through the center of Cedar Swamp, and then parallels the course of the river into Framingham, crossing the river at several points in Ashland.

3. *Geology*

The geology of the terrain through which the rail corridor passes is extremely complex. Eastern Massachusetts contains two discontinuous geological terrains, the Southeast New England Platform and the Sturbridge Geocline. The former terrain consists largely of Precambrian granites, and represents a fragment of a Paleo-African plate; the latter terrain, composed largely of pre-Ordovician metasedimentary rocks, is a foreland basin of the North American Plate. The Nashoba Thrust Belt, which separates these two terrains, represents the subduction zone at the contact of the Paleo-African plate to the southeast and the North American plate to the northwest. The Nashoba Thrust Belt contains closely spaced and steeply west-dipping thrust faults, and is bounded to the northwest by the Clinton-Newbury Fault Zone and to the southeast by the Bloody Bluff Fault Zone. The rocks of the Nashoba Thrust Belt include amphibolites, gneisses, schists, and marble, along with intrusive granites (Bell and Alvord 1976, Barosh 1986).

This local geology provided several important raw materials to prehistoric communities, notably steatite and quartzite. Prehistoric steatite quarries, which first attracted attention in the nineteenth century (Putnam 1878), occur in several parts of southern New England. The Millbury and Sutton area, in the Nashoba Thrust Belt, contains at least six quarries within 8 km. of one another, near the Blackstone River (Bullen 1940, Bullen and Howell 1943, Fowler 1966). The steatite was used, especially during the Terminal Archaic period (see next chapter for definition), for making stone vessels, which were widely traded through the region. Quartzite is a material commonly found in the Westboro Formation, immediately east of the Bloody Bluff Fault; prehistoric quarrying has been documented at several outcrops (see for example Lemire 1975). This quartzite, used to make chipped stone tools, was especially common in the Assabet and Sudbury drainages beginning in the Middle Archaic period (Ritchie 1980).

4. *Surficial Geology*

Glacial deposits of several types form a mantle over bedrock across most of the corridor. These terminal Pleistocene deposits include drumlins and till, glacial lake beds (glaciolacustrine deposits), and outwash plains (glaciofluvial deposits). More recently formed alluvial terraces are also present along streams and rivers. The next section of the report reviews the environmental history of these Quaternary land forms.

The soils along the rail corridor reflect the nature of the underlying glacial sediments. Outwash-plain sediments, extensive deposits of which are closely associated with the major constituents of the Blackstone, Assabet, and Sudbury rivers, support the Hinkley-Merrimac-Windsor soil series. Upland till, the soils of which belong to the Paxton-Woodbridge-Canton series, covers most of the areas between and along these drainages. In both settings, the soils are excessively drained and tend to be droughty, characteristics that establish the edaphic constraints for present and past forest communities, and for prehistoric horticulture. (Edaphic is a term denoting the characteristics of soils with respect to their capacity to support life.) The beds of drained glacial lakes contain muck or poorly drained soils that often form large wetland zones today, including headwaters of the Sudbury (Cedar Swamp) and Assabet rivers. Pockets of wetlands also occur at the bottoms of the swales in upland till or glacial outwash landscapes, or at the margins of streams and ponds. These wetland soils support a distinctive vegetation attractive to wildlife.

B. Environmental History

The Pleistocene period (1.8 million years to about 10,000 BP, or years before present) was marked by a succession of continental glacial ice sheets that advanced and retreated over large portions of the northern hemisphere. The last of these glacial advances, called the Wisconsin, pushed an ice sheet as far south as the area that is now Long Island, Martha's Vineyard and Nantucket. The thickness of the ice sheet situated over what is now Worcester was estimated to have been over 1,800 feet at its maximum (Massachusetts Historical Commission 1985:14). As the ice sheets began retreating, around 15,500 BP, a variety of land forms emerged in the central uplands of New England. According to Davis (1983), the glacial retreat occurred rapidly. In New England, the ice sheets retreated from Long Island to Quebec in less than 3,000 years, averaging 150 km. per 100 years. The land forms of the New England upland zone were primarily products of glacial and post-glacial deposition and erosion (Larson and Peper 1982).

One of the most significant postglacial land forms throughout the northeast is the glacial lake, which formed when ice or sediment dams blocked melt waters. Glacial lakes Assabet and Sudbury were formed in this manner (Fig. II-2a, Hoffman 1993:53). The original Glacial Lake Assabet drained eastward from the modern Assabet floodplain into the Sudbury drainage through what is now Cedar Swamp (Hoffman 1992). Glacial Lake Sudbury was formed when proglacial lake levels dropped below 300 ft. (Fig. II-2b, Hoffman 1993:53). Hoffman suggests that by the mid Holocene, lake levels may have approximated the boundaries of the present-day Cedar Swamp.

Nicholas (1991) suggests that wetlands formed a major component of the early Holocene landscape. Those wetlands were extensive, ecologically diverse, and biotically productive, reliably providing resources. Wetland environments associated with glacial lake basins were not the only focus of land use during the early postglacial period. Interior rivers and lakes, estuaries and the coastal zones were important focuses of settlement throughout the Holocene period (Nicholas 1991:42).

The succession of terminal and post-Pleistocene climatic regimes and biotic communities is best approached from pollen evidence. Pertinent pollen histories are presently available from various points across Massachusetts (Davis 1958; Whitehead 1979; Newby et al. 1986; Suter 1985; Snedden 1987). A pollen core from Cedar Swamp Pond in Westborough (Snedden and Kaplan 1987) reveals a 12,000-year pollen record similar to that of other glacially formed ponds and wetlands. The reconstruction of changing forest types from these pollen cores (see Gajewski 1988, Gaudreau 1988) reflects broad regional trends (Table II-1). The general chronology of vegetation patterns is applicable to the Sudbury/Assabet and Blackstone river drainages.

The lower portion of the Cedar Swamp core contained evidence of an open spruce woodland with jack or red pine, birch, fir, alder, and hornbeam in the area around 12,000 to 11,000 years ago. At Houghtons Pond in eastern Massachusetts, except for a herbaceous and pine pollen zone, the series of zones is similar (Newby et al. 1986). The frequency of spruce, fir, and larch of the boreal forest declined between 11,000 and 10,000 years ago, and pine-dominated coniferous forest developed. The warming climate also promoted the establishment and expansion of deciduous species like oak, birch, maple, elm and ash. After 10,000 years ago, the forest composition began shifting from a primarily coniferous to a mixed coniferous/deciduous forest, with pine decreased in frequency in favor of hemlock.

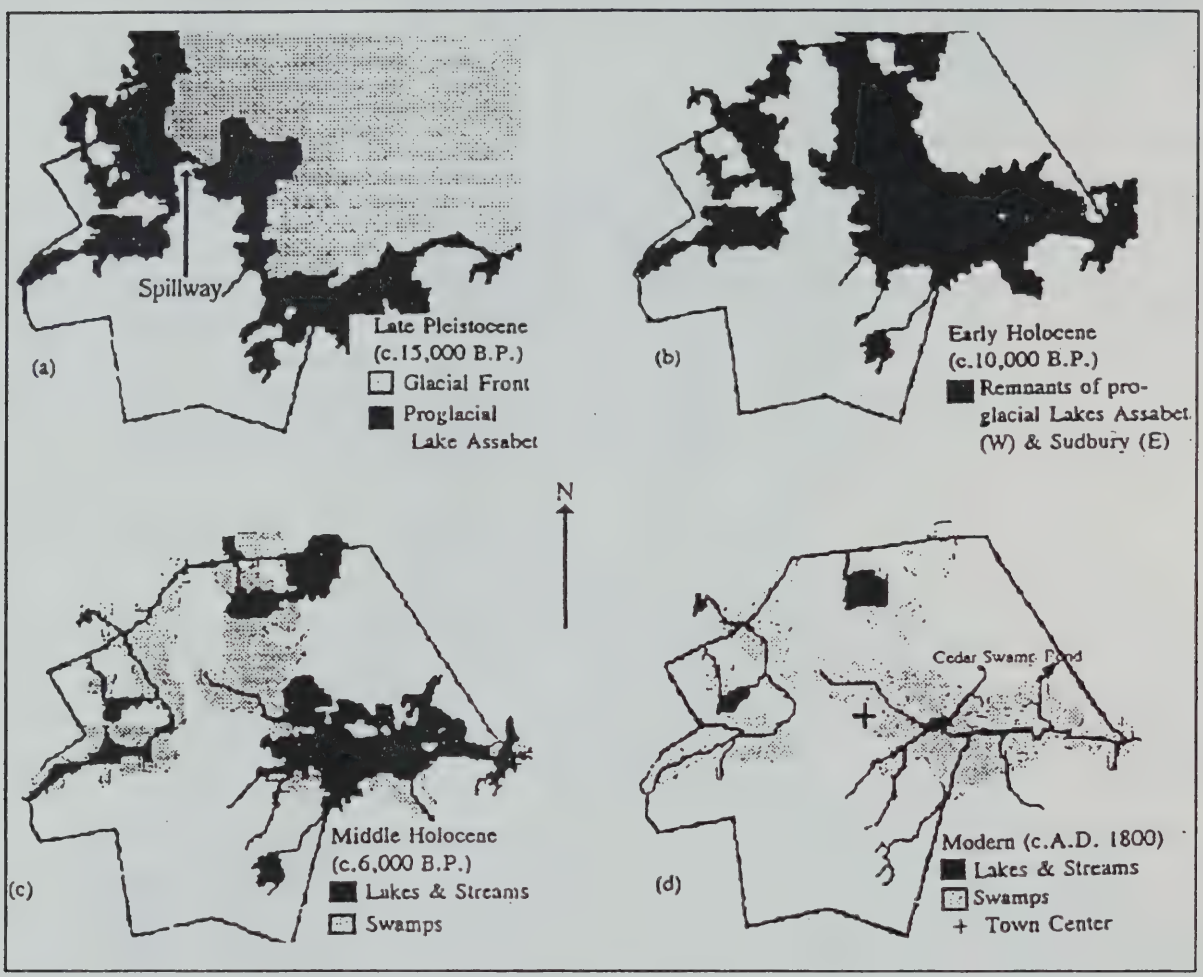


Figure II-2a Glacial retreats and lake levels in Westborough (Hoffman 1982).

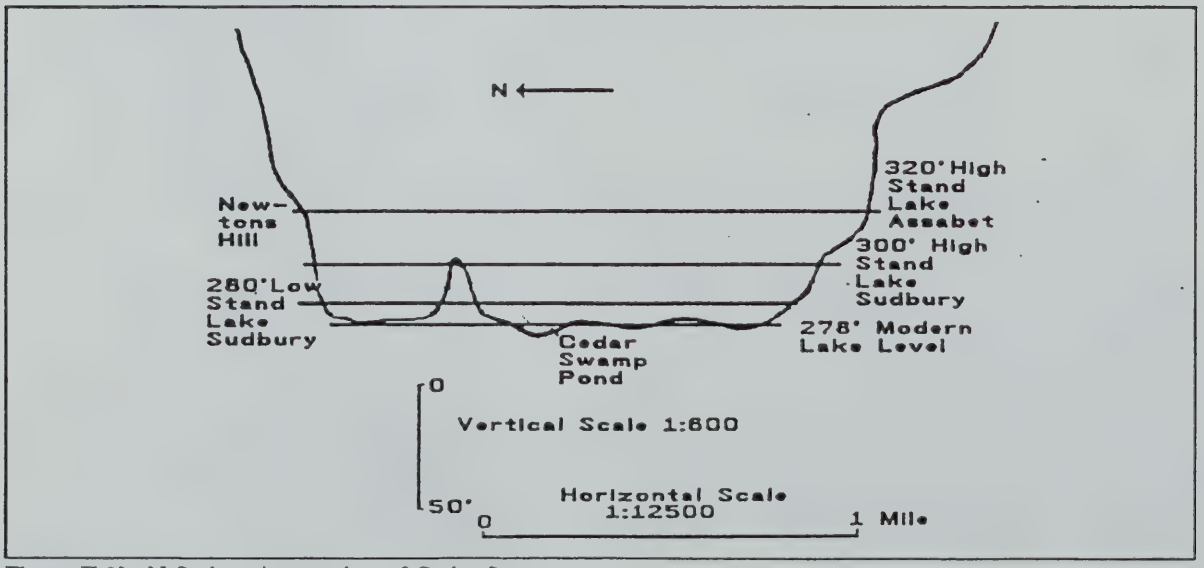


Figure II-2b N-S elevation section of Cedar Swamp.

TABLE II-1 General chronology of vegetation patterns in southern New England ca. 14,000 to 1000 years B.P

Years B.P.	Forest Types and Major Trends
13,500	Spruce parkland forest with shrub birch, alder and herbaceous plant species (sedge).
12,000 - 11,500	Pine dominant boreal forest with jack pine, red pine, spruce and alder.
10,000	More mesophytic pine dominant forest with white pine, hemlock and white birch.
8000	Oak forest established along major east/west ecotone crossing central Massachusetts. Mixed conifer/hard wood forest north of this boundary.
6000 - 4000	Hemlock and beech increase north of central Massachusetts ecotone. Oak dominant mixed deciduous forest to south of ecotone.
4000 - 3000	Oak dominant forest type with hickory, beech, yellow birch and white pine. Period of maximum diversity in regional deciduous forests.
3500 - 2000	Regional cooling trend with increase in spruce. Oak and hemlock decline, hickory and chestnut become important species.
1000 to historical period	Oak/hickory forest type with some birch and beech.

The peak warmth of the hypsithermal episode, between 8000 and 7500 BP, promoted the growth of temperate deciduous species like oak, maple, ash, elm and birch; beech comprised a significant portion of the deciduous forests, first appearing during the warm and dry climate of this period. Between approximately 8,000 and 6,000 years ago, oak-dominated forests established an ecozone crossing the southern New England region from the southwest to northeast. This boundary stretched from the southern coast of Maine across central Massachusetts and the Worcester Plateau, forming the southern boundary of a mixed conifer/hardwoods forest and the northern boundary of an oak-dominant forest that covered southern New England (Gaudreau and Webb 1985).

After 6,000 years ago, hemlock and beech increased within the mixed-hardwood deciduous forest north of the ecozone, crossing central Massachusetts. In southeastern Massachusetts, beech may have been present by 6700 BP. Hickory became established within the forest ecozone by ca. 5000 BP, while hemlock had rapidly declined by ca. 4700 BP. Some researchers suggest that the hemlock decline was the result of disease (Gaudreau and Webb 1985).

Between 4500 and 3000 BP, the regional deciduous forest was at its maximum diversity. A hardwood deciduous forest covered the upland interior of central Massachusetts, in which oak predominated but to which hickory, beech, yellow birch, and white pine contributed, along with lesser amounts of maple, elm, basswood, and some other species (Newby et al. 1985). By approximately 3000 BP., hemlock had reached its maximum decline. At about this time, evidence of eutrophication (algae bloom) in ponds, the formation of bogs and changes in vegetation had been noted from other pollen cores recovered from other sites in southeastern New England (Nelson 1984). The Cedar Swamp Pond core contained evidence of eutrophication, which has been attributed to the decline in hemlock and an increase in nutrient rich run-off from the deciduous forest. Snedden and Kaplan (1987) suggest that the occupation of upland areas, adjacent to wetland and ponds, may have also contributed to eutrophication.

From approximately 3500 to 2000 BP, the proportion of oak slightly declined in the forests of central Massachusetts, possibly a response to cooler, more moderate climatic conditions. Birch, beech, ash, elm, and maple were also present, with small amounts of spruce and white pine. Small percentages of hemlock persisted for 1,000 years after its decline in the region. During this period, hickory and chestnut became important in the forest composition. Also, the pollen records of wetlands in eastern/southeastern Massachusetts indicate that cedar first became established in the area by approximately 2500 BP (Snedden and Kaplan 1987).

From 2000 to ca. 300 BP, the oak/hickory forest association, in which figured some birch and beech, became dominant. Some indications of forest clearance or alteration that occurred about a thousand years ago are evident in pollen cores from wetlands in southern Rhode Island and southeastern Massachusetts. During the late Prehistoric period, forests shifted slightly to an oak/chestnut type with hemlock, hickory, beech, birch, pine and maple. Over the last 300 years, the effects of forest clearance are evident in pollen-cores taken from wetlands and ponds in southeastern New England. Decreases in tree pollen occurred as pollen from weedy plants and grasses increased (Newby et al. 1986; Nelson 1984).

III. PREHISTORIC BACKGROUND

The prehistory of New England is poorly understood relative to that of other regions in North America. The purpose of this introductory section is to sketch the main trends of Massachusetts prehistory and to identify evidence pertinent to the project area, in order to provide the prehistoric background needed for the interpretation of this survey.

For most of the prehistory in the region, river drainages defined physiographic units within which human communities operated. This pattern follows from the longitudinal diversity of habitats that occurs along drainages, forming ecologically unique wetland habitats, together with the transportation routes afforded by their water courses. In the clearest examples, rivers provide access to maritime and upland resources at each end of the drainage, and to the diverse habitats in between. The exploitation of those habitats can be integrated into a seasonal round that differs at various historical moments.

The following review is arranged chronologically by major periods recognized for New England. Each chronological section will present the major trends and patterns and relate them to the available local evidence. The absolute dates for each period, given as years before present (BP) must be regarded as having a substantial potential for revision.

A. Paleoindian (12,000-9000 BP) and Early Archaic (9000-8000 BP)

The first human communities in southern New England fall into two periods, identified principally by characteristic projectile-point types. The earlier, Paleoindian period is identified by fluted points, and the latter, Early Archaic period by Bifurcate Base points. Both periods are poorly known in southern New England. Although many commentators see a sharp division between these two periods (derived from a perceived typological discontinuity) and perhaps even a regional depopulation at the end of the Paleoindian period, this view is premature.

The human communities that initially colonized southern New England faced a rapidly changing landscape, one in which resources were of low density and relatively unpredictable. This condition resulted in very generalist adaptation, with emphasis on flexibility, mobility, large and probably loosely defined foraging territories, and maintenance of wide kinship ties (Dincauze 1980, Snow 1980). As the physical environment began to stabilize, that is, changed less quickly and became more predictable, groups grew less generalized in adaptation and settled into more restricted foraging territories. Recent interpretations have stressed the importance to these initial adaptive patterns of the varied habitats that formed in the drained beds of glacial lakes, where extensive wetlands provided relatively rich and predictable resources (Nicholas 1988).

While no Paleoindian sites have been recorded near the WCRE project corridor, some isolated find spots are reported for the general region. These sites are located within the Assabet and Sudbury drainages in Concord (19-MD-94), Wayland (Heard Pond), and Northborough (find spot, MHC site files).

The Early Archaic period is almost as sparsely represented as the Paleoindian period. Early Archaic Bifurcate Base points have been recovered from sites located within the Assabet and Sudbury drainages (MHC site files; Hoffman 1993). Some of these sites include: along the Assabet, the Bombard Site; along the Sudbury, Heard

Pond, Davis Farm, Hocomonco Pond in Westboro, and at Morse Farm. During this period, there appears to have been a variation in site selection as reflected by the locations of find spots, utilizing not only the wetland/riverine ecozones, but also areas outside the riverine zone within the upland areas (Morse Farm). This may reflect a settlement and resource-procurement system focusing on seasonally abundant resources (Massachusetts Historical Commission 1985).

B. The Middle Archaic (8000-6000 BP)

Throughout southern New England, human occupation becomes more evident and apparently more complex during the Middle Archaic. The greater number of sites relates to a presumed increased population density, while the greater disparity in size and differentiation of individual sites suggests a more complexly ordered social landscape than those previously found. Indeed, Dincauze and Mulholland (1977) have suggested that effective integration of seasonally available resources into a single adaptive schedule appeared during this period, while maintenance of territorial boundaries between groups intensified in consequence to this emergent adaptation; this response was in large measure doubtless a consequence of more stable regional environments. The distribution of Middle Archaic sites in southern New England, in addition to the pattern of lithic-resource use, has been interpreted as reflecting intensive use of locally available resources within established territories defined by river drainages (Dincauze and Mulholland 1977:441). The earliest documented harvesting of anadromous fish during spring runs up the Connecticut River, seen in Gill (Thomas 1980) and argued elsewhere in southern New England (for example, Dincauze 1976), marks both a fundamental adaptation to foraging possibilities and a seasonal determinant of site location, that is, spring occupations at rapids, falls and constrictions on larger river courses. Exploitation of anadromous fish, begun in the Middle, if not Early, Archaic period, continued throughout the rest of regional prehistory as a principal component of aboriginal economies.

Middle Archaic sites are slightly more abundant than those from the earlier periods discussed above. Neville and Stark points attributed to the Middle Archaic have been recovered from sites within the Cedar Swamp Archaeological District, within the Sudbury drainage, Hocomonco Pond, and Charlestown Meadows within the Assabet drainage. These drainages appear to be the major focus of activity during this period. Sites are located within a variety of riverine and upland settings, ranging from small, single-component sites in the uplands to large, multicomponent sites in the riverine zones. Local raw materials were procured from the Westboro Formation found in the upland outcrops of the Sudbury/Assabet drainage.

C. The Late Archaic (6000-3000 BP)

The Late Archaic period in southern New England is traditionally viewed as a bundle of three major traditions: 1) the Small Stemmed (Small Stemmed and Small Triangle point types), 2) the Laurentian (especially the various Brewerton point types), and 3) the Susquehanna (Atlantic, Susquehanna Broad, Wayland Notched, and other point types). These traditions may represent culturally distinct communities that spaced themselves in the landscape by ecological specialization and mortuary ceremonialism (Dincauze 1968, 1971, 1972, 1975; Turnbaugh 1975; Lavin 1988; Pagoulatos 1988). Alternatively, the lithic "traditions" may simply express a functional differentiation of tool types and/or knapping qualities of raw materials (Cook 1976; Custer 1984).

The Late Archaic is the most visible period of Massachusetts prehistory, in terms both of numbers of sites and of typological attribution of materials. While Laurentian and Susquehanna point types may indeed be confined chronologically to specific ranges within the Late Archaic period, Small Stemmed is now known to have extended into the Early Woodland period. Thus Small Stemmed points are chronologically imprecise, and occur over a period of some 4,000 years or more. This chronological ambiguity severely distorts reconstructions of demography and economic patterns, since the picture of a population peak in the Late Archaic and subsequent collapse is based largely on the Small Stemmed evidence. However, even accounting for this distortion, Late Archaic patterns in Massachusetts indicate unprecedented population density, with communities well settled into narrow foraging territories defined by drainages, and highly specialized for exploitation of the habitats within these drainages.

Confined to those territories, extractive activities were seasonally adjusted to meet the opportunities of the annual cycle. Sites are located in a wide variety of topographic situations: river banks; margins of lakes, ponds, bogs and springs; around meadow lands; in rock shelters and at quarries; and along the coastline. The differentiation of site size suggests use of a radiating, seasonally dynamic settlement pattern (Dincauze 1974, 1975, 1980; Thorbahn and Cox 1983). Although technological innovations (such as pestles and stone bowls) are apparent in this period, and some long-distance exchange of materials occurred, emphasis seems to have been placed increasingly on locally available raw materials for chipped stone tools, often distributed within river drainages. Since at the regional scale the southern New England landscape is a highly heterogeneous one, this adaptive pattern led to local specialization and to strong regional variation in assemblage characteristics (Dincauze 1980). This arrangement of human communities is best viewed as a response to establishment of the temperate forest, in which resources are heterogeneous, but relatively stable and predictable.

The Late Archaic contains the greatest frequency of sites with the widest distribution of sites found in different environmental zones thus far discussed. A number of Late Archaic sites have been identified within the Sudbury and Assabet drainages. An important cluster of sites has been identified within the upland pond (Hocomonco Pond) and wetland (Cedar Swamp and Cold Brook) ecozones. Other sites have been identified in upland areas (Flagg Swamp Rock Shelter) and riverine areas (Robin Hill, Davis Pond).

D. The Woodland Period (3000-450 BP)

The Woodland is traditionally divided into Early (3000-1700 BP), Middle (1700-1200 BP) and Late (1200-400 BP) periods, defined by changing artifact types. Dincauze has argued (1974:49-50) a regional demographic collapse and a shift during the Terminal Archaic to coastal settings, thus largely depopulating interior upland regions, perhaps in response to the cooler and wetter conditions that then prevailed (see Barber 1979:230-32). However, interior regions continued to exploit riverine/wetland zones, as identified from the cultural materials recovered from sites such as Cedar Swamp and Hocomonco Pond (MHC site files). From this presumed demographic low point, populations grew in size and density through the Woodland, culminating in the Late Woodland. This model of demographic collapse and gradual recovery must be regarded as unproven (see Thorbahn 1982).

The Woodland periods are marked by basic technological and economic changes, notably the production and use of pottery and a gradual shift to food production. Elsewhere in eastern North America, cultivation and eventual domestication of indigenous seed plants (e.g. sumpweed, chenopods, sunflower) is evident during Middle and

Late Archaic times. In southern New England, indigenous systems of food production are not firmly documented. Chenopod consumption appears with the Middle Archaic (e.g. the Heath Brook Site in Tewksbury), and storage of chenopods is evident, at least locally, by the end of the Late Archaic (McBride and Dewar 1987:308). But these finds refer to morphologically wild plants, and so probably to their collection rather than cultivation. Southern New England horticulture cannot firmly be identified until the appearance of tropical cultigens (maize, beans, squash) at the end of the Middle Archaic (e.g. on Martha's Vineyard, Ritchie 1969); during the Late Woodland period, horticulture intensified, becoming a focal activity.

Within Massachusetts generally, the Woodland periods are best known in the coastal regions and in the Connecticut River Valley. Mulholland's recent study indicates that settlements during the Woodland periods were increasingly oriented to the coast and to zones of extensive alluvial terraces, a reflection of the developing importance of horticulture to the regional subsistence economy (Mulholland 1988). In both cases, this higher visibility may be ascribed to local opportunities for increasing sedentism and larger communities, due in the former area to a combination of horticulture with rich marine resources and in the latter area to large expanses of soils well suited to horticulture in combination with rich fish harvesting and other terrestrial resources. The emphasis on coastal settings was not uniform, however, but responded to local environments in the context of food production.

The Early Woodland is well represented within the Cedar Swamp District. The large multicomponent sites are characterized by major communal facilities (Hoffman 1993). There was a strong tendency toward the use of local quartz, quartzite, and Milford granite. The Middle Woodland period has been characterized as a period of increasing population and intensive long-distance interaction, as is evident through the increase in jasper and chert found in Cedar Swamp sites and the recovery of Westboro quartzite from sites located within the Boston Basin. The Late Woodland is also represented within the Cedar Swamp District. Several other Late Woodland sites in the region have been identified within the Assabet and Sudbury drainages (Flagg Swamp Rock Shelter, Heard Pond and Weir Hill No. 2).

E. The Contact Period (AD 1500-1700)

This period marks the initial presence in the region of European explorers and fishermen, followed in the early seventeenth century by English colonization, at least from the European perspective. From the aboriginal perspective, the period was one of intense social, economic and demographic disruption and eventually virtual extinction.

The Nipmuc group occupied the WCRE rail corridor in the early seventeenth century. The Native American communities of the interior are recorded in far less detail than those in the coastal areas of southern New England, and relatively little is known of Nipmuc ethnohistory. One early English observer, Daniel Gookin, reported that coastal communities imposed tribute on groups of the interior, though these exactions may have been payments for access to the coast (Salwen 1978). Excluded by their geographical location from enjoying the benefits of littoral habitats, the Nipmuc and other interior groups probably relied less heavily on horticulture than did their neighbors on the coast or in the Connecticut River Valley, and exhibited less strongly the changes in sedentism and political complexity. A dense trail network linked the Nipmuc communities together, and gave them access to other parts of New England. One regional trail ran from Massachusetts Bay to Connecticut, crossing the Blackstone in Millbury, while another ran north-south through Southborough and across the Sudbury River (Laden 1991:15-19; Town of Millbury 1915:13).

The English penetration of the interior was well under way by the mid seventeenth century. In many areas, English settlers occupied land by individual purchase and grants from the General Court. Native groups retained control of other lands, but often under the constraint of John Eliot's Praying Indian Village system. Eliot established praying villages at Magunco Hill in Ashland (1659; Temple 1887:61-63) and at Hassanamisco in Grafton, among other places.

The history of the Hassanamisco community provides a typical example of the fate of the praying villages. Establishing the praying village with a land grant from the General Court in 1660, John Eliot tried unsuccessfully to make the Nipmuc adopt English architectural styles and manner of life, but was somewhat more successful in converting local Nipmuc to the Puritan religion. The town was not completely enculturated, however, and during King Philip's War many Hassanamisco Nipmuc supported the traditional cause (Pierce 1879:29-34). Declining population, indebtedness, and other encumbrances afflicted the village during the last quarter of the seventeenth century, and sale of village lands began in the eighteenth century. Elishu Johnson made the first purchase of village land in 1718, and in 1728 the seven remaining Nipmuc families sold major portions of their holdings.

While no Contact period sites are recorded within the WCRE project corridor, sites of the period do exist in the area. Contact period settlement occurred around Chauncy Lake and Hocomonco Pond in Westborough (Massachusetts Historical Commission 1983b:2), and early records mention a wigwam in the northeast of the town (Allen 1984:6-7). Hoffman (1992:9-10) states that there are few seventeenth-century historical records of Native Americans in Westborough, although oral tradition reports Native use of Cedar Swamp into the nineteenth century (see also Leveillee 1992).

IV. HISTORIC BACKGROUND

Historical background research for the WCRE project focused on the role that the railroad played in the history of land use and settlement location within each town along the rail corridor. This research emphasis yields several kinds of conclusions pertinent to the historic-archaeological potential of the rail corridor. The background research distinguishes pre-1830s and post-1830s patterns of land use in each town, and identifies both known and potential archaeological resources along the rail corridor for both periods. At the same time, the research framework provides the basis for assessing the historic contexts of both known and expected archaeological resources, and for evaluating the potential significance of these resources once they have been identified in the field.

A. Boston and Worcester Railroad

The Boston and Lowell Railroad was, in 1831, the first railroad constructed in Massachusetts; others soon followed. The General Court sanctioned the incorporation of the Boston and Worcester Railroad as a private stock company, in 1831. Construction for the Boston and Worcester began in 1832, and the first scheduled passenger train ran between Boston and Newton in April, 1834. The track had reached Westborough by November, 1834, and the line to Worcester opened on the Fourth of July, 1835. When completed, the Boston and Worcester railroad spanned 44 1/2 mi., and contained 18 flat segments and 30 additional segments of variable inclination. To maintain an easy gradient, the railroad constructed two 40-ft. cuts through solid rock: one at Cutler's Summit in Grafton,and the second at the Worcester Summit on the eastern edge of that city. The majority of the line, however, required only minor cutting and filling (Salsbury 1967:103-104).

One of the major problems in the development of railroad transportation was financial backing. Political support came from rising industrialists and manufacturers, who recognized the advantage of a rapid transportation system. The anticipated costs of constructing and developing the system, however, made the industrialists seek state financial assistance. Railroad supporters envisaged two possible operating methods: one based on the canal or turnpike system, with the state furnishing only the track and relying on private individuals to supply locomotive power and equipment. The alternative was a state railroad that owned all movable equipment. The issue was moot, because in 1830 the Massachusetts legislature rejected the railroad bill, despite strong political backing from influential newspaper editor Nathan Hale and industrialists David Henshaw and William Jackson (Salsbury 1967:31-61).

The construction of the railroad thus devolved onto private developers. In June, 1831, the Massachusetts General Court sanctioned the incorporation of the Boston and Western Railroad, with a charter that allowed for 10,000 shares of capital stock. The corporation's directors had complete freedom in selecting the route and the locations of the terminals, but property owners were compensated for seized or damaged land. The railroad had the right to raise or lower any road or canal so that track could pass under or over it, but the railroad could not cut off or obstruct old roads of canals. The railroad also maintained responsibility for the upkeep of bridges and underpasses (Salsbury 1967:75-91).

The chosen route required the construction of two major bridges. The first, one-and-a-half miles long, formed a viaduct across the full and receiving basins of the Boston Water Power Company. The viaduct was constructed of 1,700 ft. of wooden trestle, filled with a solid earth embankment and anchored by masonry walls. The

second major bridge spanned the Charles River at the Newton-Weston town line. The bridge was formed of a 120-ft. wooden span that rested on masonry abutments and rose 30 feet above the water surface. The remaining bridges along the line were masonry, often constructed of granite with hammered joints (Salsbury 1967:104).

The original specifications of the line included iron edge rails weighing 40 lbs. to the yard. These rails rested on cast iron "chairs" that weighed 15 lbs. each. The chairs were spaced three ft. apart, and were fastened to transverse or crossing cedar ties. To construct the rail bed, crews dug a continuous track 2-3 ft. deep under each rail, which was filled with compact stone rubble to form the foundation for the ties. The center part of each tie rested on plain earth, and during freeze-thaw cycles the ties twisted out of place. After the first winter, the rail bed was constructed from foot-deep ballast that spanned the entire width of the bed and the ties were embedded completely in the crushed rock ballast, thereby achieving the stability to withstand the stresses of New England winters. By 1836, the rail bed had essentially achieved the form that it maintains today (Salsbury 1967:104-105).

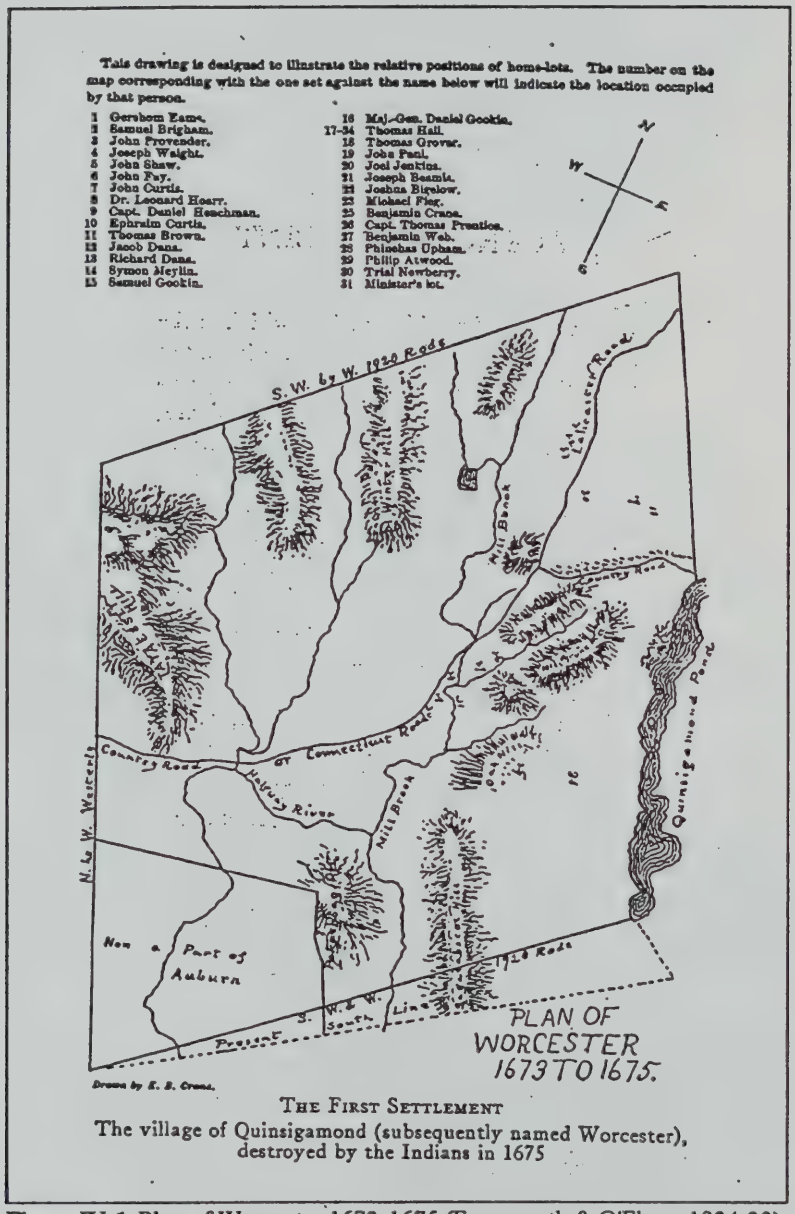
B. Worcester

Originally known as the Quinsigamond Plantation, Worcester's initial grant was drawn up in 1668 and the town was first settled in 1673. An early map of the settlement shows apportioned lots in the area west of Lake Quinsigamond, on the plateau defined by the Tataesset, Pakachoag, and Winter hills (Fig. IV-1; Farnsworth and O'Flynn 1934:20). When the Nipmuc people of Pakachoag joined King Philip's uprising against colonization (1675), the English virtually abandoned Worcester. After King Philip's War, English settlers filtered back to the area, and by 1683 had established a second settlement in Worcester. Allotments of the 43,000 acres of the second settlement lay east of Pakachoag Hill, west of Mill Brook and on Sagatabscot Hill (Farnsworth and O'Flynn 1934:20, 36). The continued hostility between the settlers and the Indians also doomed this settlement.

The third and final settlement of Worcester began in 1713 with settlers' cabins at Sagatabscot Hill and Oak Hill. Settlers erected a log fort on the western side of Main Street near Chatham, and garrisons at the junction of Main and Exchange streets and between Prescott and Lincoln streets (Farnsworth and O'Flynn 1934:45). Additional blockhouses were erected near Mill Brook (to protect an early grist mill) and near Adams Square. Further settlement concentrated in the area of Franklin Street, Green Street and Main Street, where the first meeting house was erected. The common, located along Main Street near today's City Hall, provided the space for an early burial ground and cattle pasture (Fig. IV-2; Farnsworth and O'Flynn 1934:105).

The plantation gained official recognition as a town in 1722, and became the county seat of the newly formed Worcester County in 1731. The town lost small tracts of land to Holden (1741) and Auburn (1778), while annexing lands in 1743, 1785 and 1758. Worcester was incorporated as a city in 1848 (Massachusetts Historical Commission 1984b:1; Farnsworth and O'Flynn 1934:21-42).

The presence of the county courts provided tremendous impetus to the town. Taverns and hotels -- like the King's Arms on Elm Street, the Hancock Arms near Lincoln Street, and the United States Arms on the corner of Main and Exchange streets -- sprang up to accommodate court participants (Erskine 1981:43; Farnsworth and O'Flynn 1934:70-71). During court sessions, a general air of festivity prevailed, at which time exhibitions, boxing matches, markets, and races dominated town activities (Farnsworth and O'Flynn 1934:46-47; Massachusetts Historical Commission 1984b:3). Indeed Worcester's role as the trading center of the county may



THE FIRST SETTLEMENT
The village of Quinsigamond (subsequently named Worcester), destroyed by the Indians in 1675

Figure IV-1 Plan of Worcester 1673-1675 (Farnsworth & O'Flynn 1934:20).

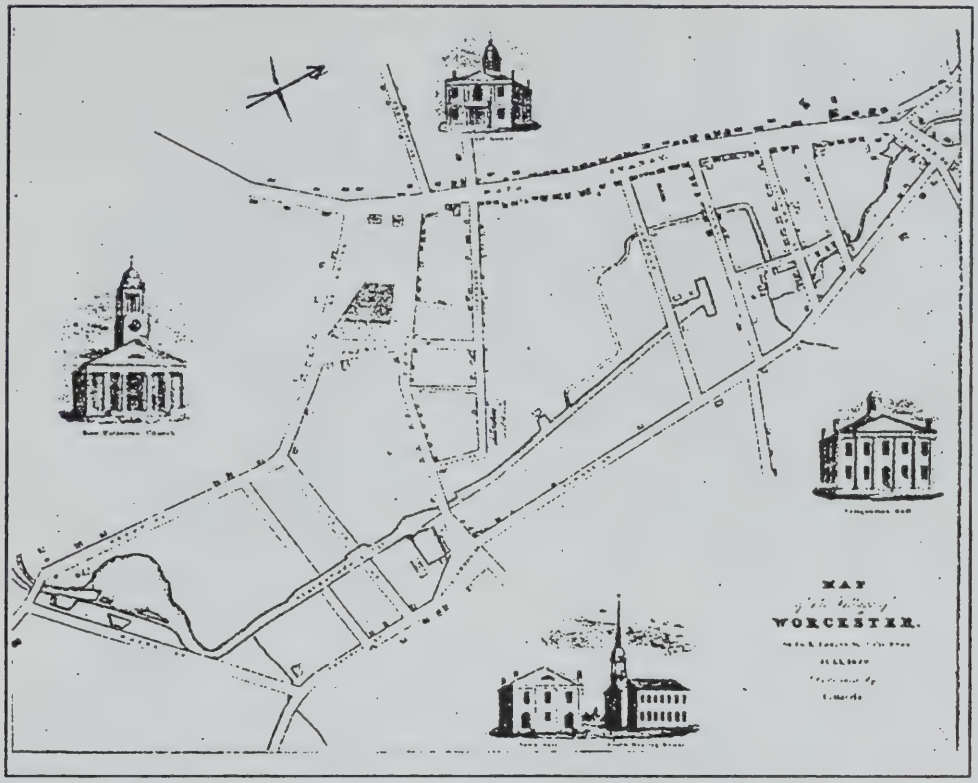


Figure IV-2 Map of the Village of Worcester (Farnsworth & O'Flynn 1934:105). (No scale available.)

have begun with the markets that accompanied court sessions. Stephen Salisbury's financial empire dates to this era in the town's history (Massachusetts Historical Commission 1984b:7). A variety of institutions arose in response to the social aspirations of the shire town's residents. These institutions included the American Antiquarian Society (1812), the Worcester Lyceum (1829), the Worcester Athenaeum (1830), and Mechanics Hall (1857) (Farnsworth and O'Flynn 1934:116, 146,196, 200; Massachusetts Historical Commission 1984b:13). A variety of educational establishments responded to the educational demands of the wealthy classes, including Holy Cross College (1843), Worcester Polytechnic Institute (1865) and Clark University (1889).

Industrial growth paralleled the institutional development of Worcester. The Worcester Cotton Manufacturing Company began manufacturing textiles at Mill Brook near School Street by 1789. Tatnuck, Kettle, Beaver and Mill brooks remained prime locations for early mills into the eighteenth century. By 1793, Worcester boasted a paper mill at Quinsigamond Village south of the city (Farnsworth and O'Flynn 1934:131). By 1810, the first water-powered spinning cotton yard factory was built at Kettle Brook (Massachusetts Historical Commission 1984b:8). During the expansive early industrial period (1830-1870) settlement pushed up the surrounding hillsides from the densely settled central valley (Massachusetts Historical Commission 1984b:12).

Of great importance to burgeoning industrial growth was the construction (1826-1828) of the Blackstone Canal. Linking Worcester with Providence, the canal measured forty-five miles long, and contained sixty-two locks to accommodate the 451-ft. drop in elevation (Erskine 1981:52). The canal measured 18 ft. wide at the bottom, and 36 ft. wide at the top, and cost $750,000 to construct (Pierce 1879:320). The first shipment from

Providence arrived on October 7, 1828 and included slate and grain; the return cargo was comprised of butter, cheese and coal, mined near Lake Quinsigamond (Farnsworth and O'Flynn 1934:98-100). The influence of the canal on the location of structures is evident from a plan dated to 1830 (Erskine 1981:55; Fig. IV-3). The plan shows blocks of shops, sheds, barns, stores and hotels between Summer Street and Main Street, in addition to a covered rope walk that crosses the canal (Erskine 1981:55). Yet despite the optimism of merchants and artisans, difficulties in canal operation quickly became apparent. The waters iced over in winter and the banks eroded with the spring thaw, while the mills along the route drew off too much water. Maintenance costs became prohibitive, and the canal ultimately proved an unreliable venture. Investors turned to the railroad for an alternative means of transportation, and by 1848 the canal was abandoned (Erskine 1981:53, 57, Farnsworth and O'Flynn 1934:99-100).

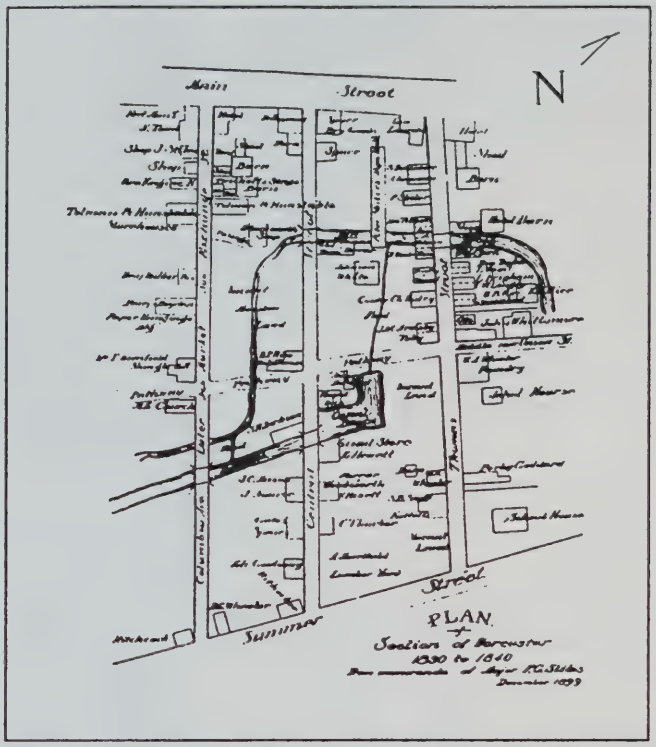


Figure IV-3 Plan of section of Worcester 1830-1840 (Erskine 1981:54). (No scale available.)

Even before the canal was abandoned, investors had acknowledged the potential of the newly invented railroad with their support of the Boston and Worcester Railroad Company. Charted in 1831, the Boston and Worcester Railroad reached Worcester by 1835. By 1839, the line to Springfield was complete, and the cities of Boston and Albany were linked with the merger of the Boston and Worcester and the Western Railroad in 1867 (Hart 1930:401). By the end of the century, additional lines ran from Worcester to Nashua, New Hampshire, New London, Connecticut and Providence, Rhode Island (Erskine 1981:58, 93; Farnsworth and O'Flynn 1934:133-134). With the completion of these lines, Worcester became a central node in a transportation system that stretched across the east coast, delivering raw materials and manufactured products to five states.

The impetus for the mid-nineteenth-century industrial boom in Worcester came not only from transportation developments, but from an allied industrial invention - the steam engine. Not only did steam power passenger and freight trains, it also supplied an element missing from Worcester's economic base - reliable source of water power (Farnsworth and O'Flynn 1934:133-134). Stephen Salisbury II was quick to exploit the entrepreneurial potential of steam by renting both steam-powered machinery and factory buildings to small businesses and individual mechanics (Massachusetts Historical Commission 1984b:14). A series of factories operating under the rental system opened along the Western, and Norwich and Worcester rail corridors to the south and west of the original manufacturing district at Lincoln Square. Rental factories included the Merrifield Building along Union Street, the Red Mill at the junction of Green and Water streets, and the Junction and Lower Junction shops near the intersection of Southbridge and Sargent streets. By the 1850s, a variety of manufacturers coexisted in industrial vigor: machine-tool, water-wheel, and metal manufacturers, textile and wood-working machinery makers, a woolen mill, and a cast-iron foundry (Massachusetts Historical Commission 1984b:14).

Despite this nineteenth-century industrial growth along rail lines and the Blackstone Canal, development was far less intensive along the WCRE project corridor to the east of the city center. Beers (1870) shows few structures located along the Boston and Albany rail corridor between Worcester and Millbury (Fig. IV-4). Exceptions include the Wm. Eaton Brick Yard near Bloomingdale Street (Fig. IV-5). Some industrial structures stood closer to the town center and are directly related to the railroad. These include buildings in the Boston and Albany Yards on Bloomingdale Street. They also include a coal elevator and a grain elevator at the corner of Grafton Street and Bloomingdale Street, in addition to Boston and Albany Railroad sheds located near Lyon and East Worcester streets (Fig. IV-6; Richards 1898). This configuration remained essentially unchanged in the early twentieth century, with the exception of a coal-company structure, a lardworks along the rail corridor near Putnam Lane, and some small dwellings near the intersection of Aitcheson and Plantation streets (Figs. IV-7 and IV-8; Richards 1911).

The industrial development of Worcester thus demonstrates a pattern of clustering along transportation arteries. This is particularly evident along the Blackstone Canal, at the junction of the Norwich and Worcester, and Providence and Worcester rail lines, and along the southern corridor of the Providence and Worcester rail lines. This appears to contrast significantly with the lack of clustering along the corridor of the Boston and Albany line in the eastern portion of the city and toward Millbury.

C. Millbury

English settlement in Millbury began by 1679, when John Wampus, "the Indian proprietor of all this territory," alienated a large tract of land (Town of Millbury 1915:29). By 1704, the town was officially sanctioned as a colonial plantation and by 1714 was incorporated as a town. The original grant included portions of the present towns of Sutton, Millbury and Auburn. Originally part of the "Second Parish" of Sutton, the present town was incorporated in 1813 (Massachusetts Historical Commission 1989:1). Known as a prosperous farming community with productive grass crops, fruit orchards and livestock, Millbury's early farmsteads were dispersed around the common and meeting house. Original industries were located around Singletary Pond, and along the Blackstone River. These included a 1740s iron refinery on the Blackstone River, used to manufacture wrought iron from local ores. The refinery was later converted to an armory by Asa and Elijah Waters. A fulling mill operated on Singletary Brook by 1750, and within a decade a linseed-oil mill was added upstream (Massachusetts Historical Commission 1989:3; Pierce 1837).

Early nineteenth-century development along the Blackstone may have been stimulated by the movement of Asa and Elijah Waters' armory to South Main Street in 1808 (Massachusetts Historical Commission 1989:6). More important was the creation of the Blackstone Canal in 1828. The canal required nine locks to accommodate changes in elevation within the town of Millbury alone (Massachusetts Historical Commission 1989:5) and attracted settlement and industry away from the original town center. By 1831, a concentration of institutions had appeared on the west bank of the Blackstone Canal, while the old town center and the Congregational Church appear to have remained isolated and undeveloped (Fig. IV-9; Pierce 1837). This trend greatly strengthened during the next half century, even after the canal fell into disuse; in 1870, densely concentrated structures lined the Blackstone River, while the former town center (identified as the "Old Common") contained only private dwellings around the common (Fig. IV-10; Beers 1870).

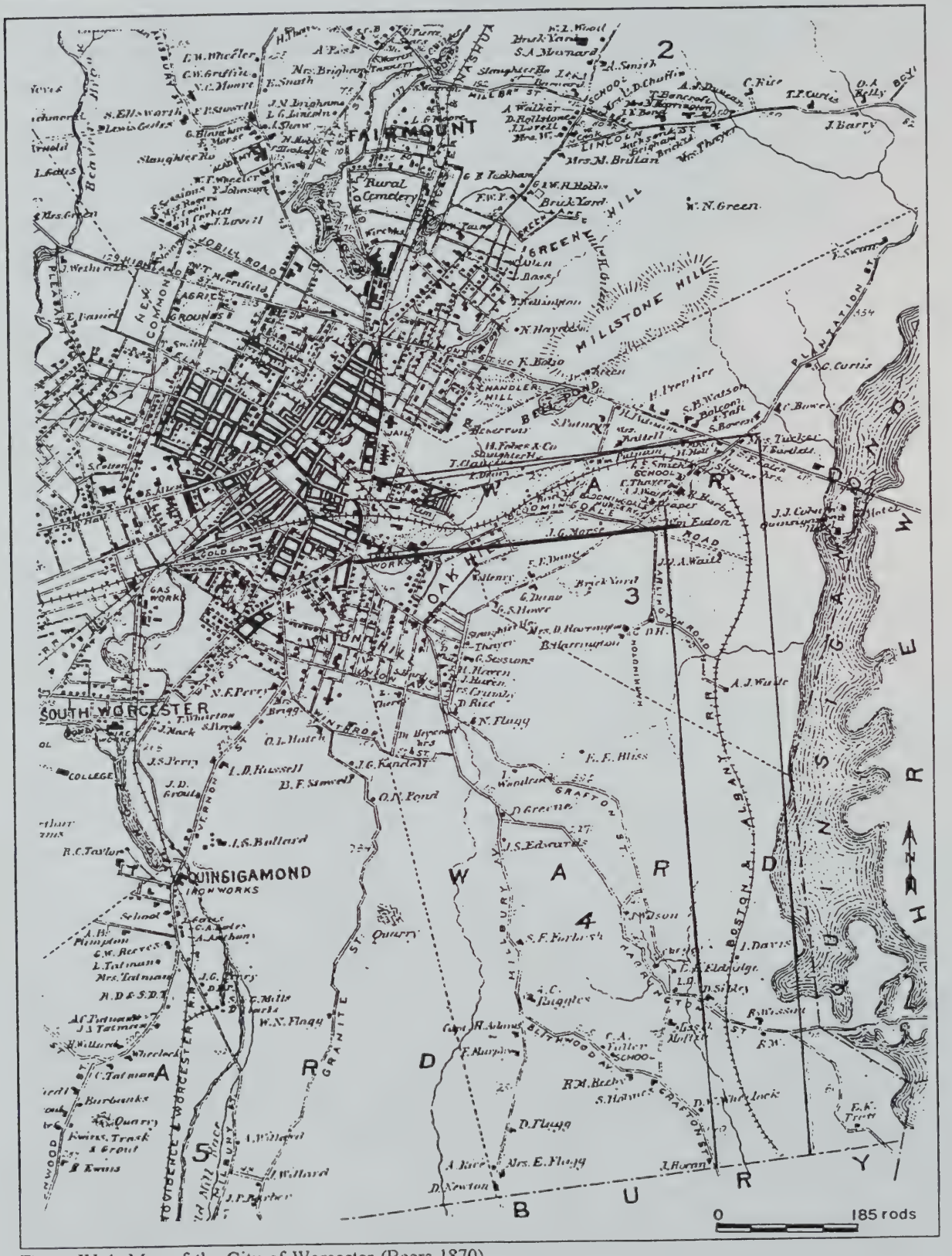


Figure IV-4 Map of the City of Worcester (Beers 1870).

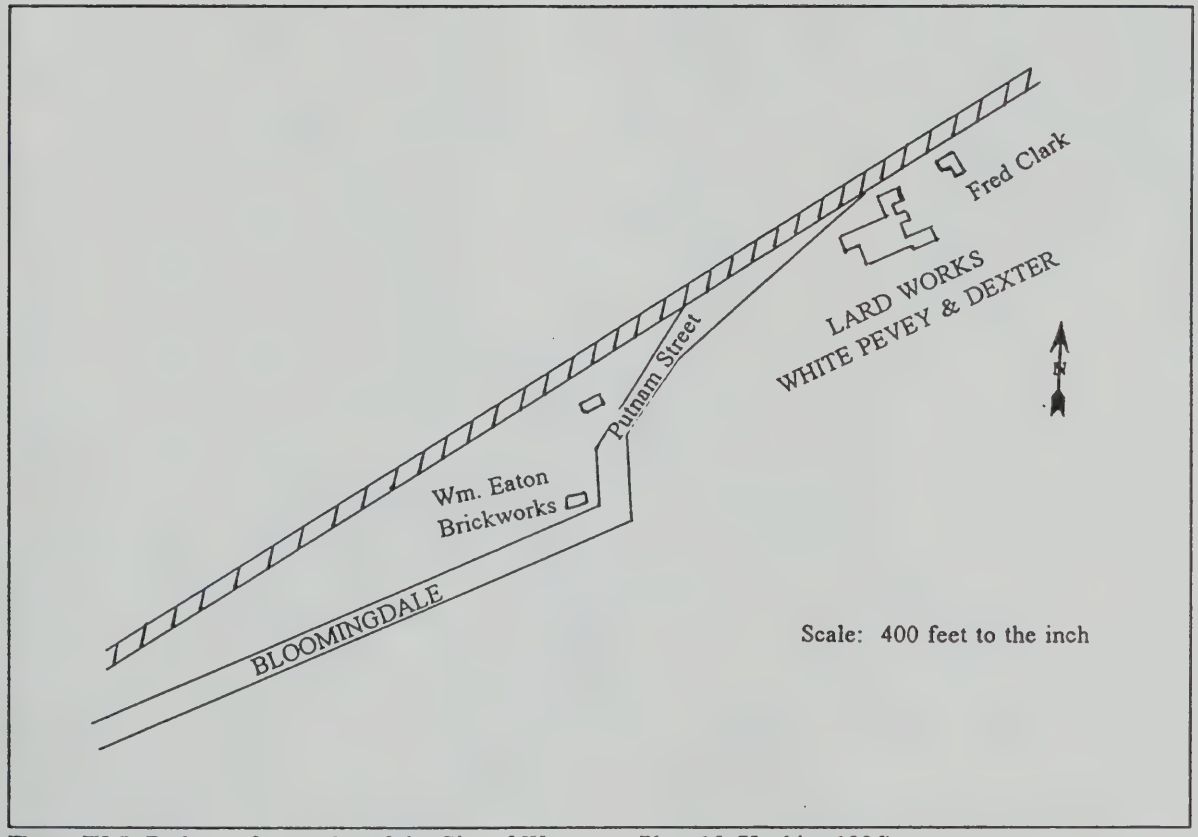


Figure IV-5 Redrawn from Atlas of the City of Worcester, Plate 15 (Hopkins 1886).

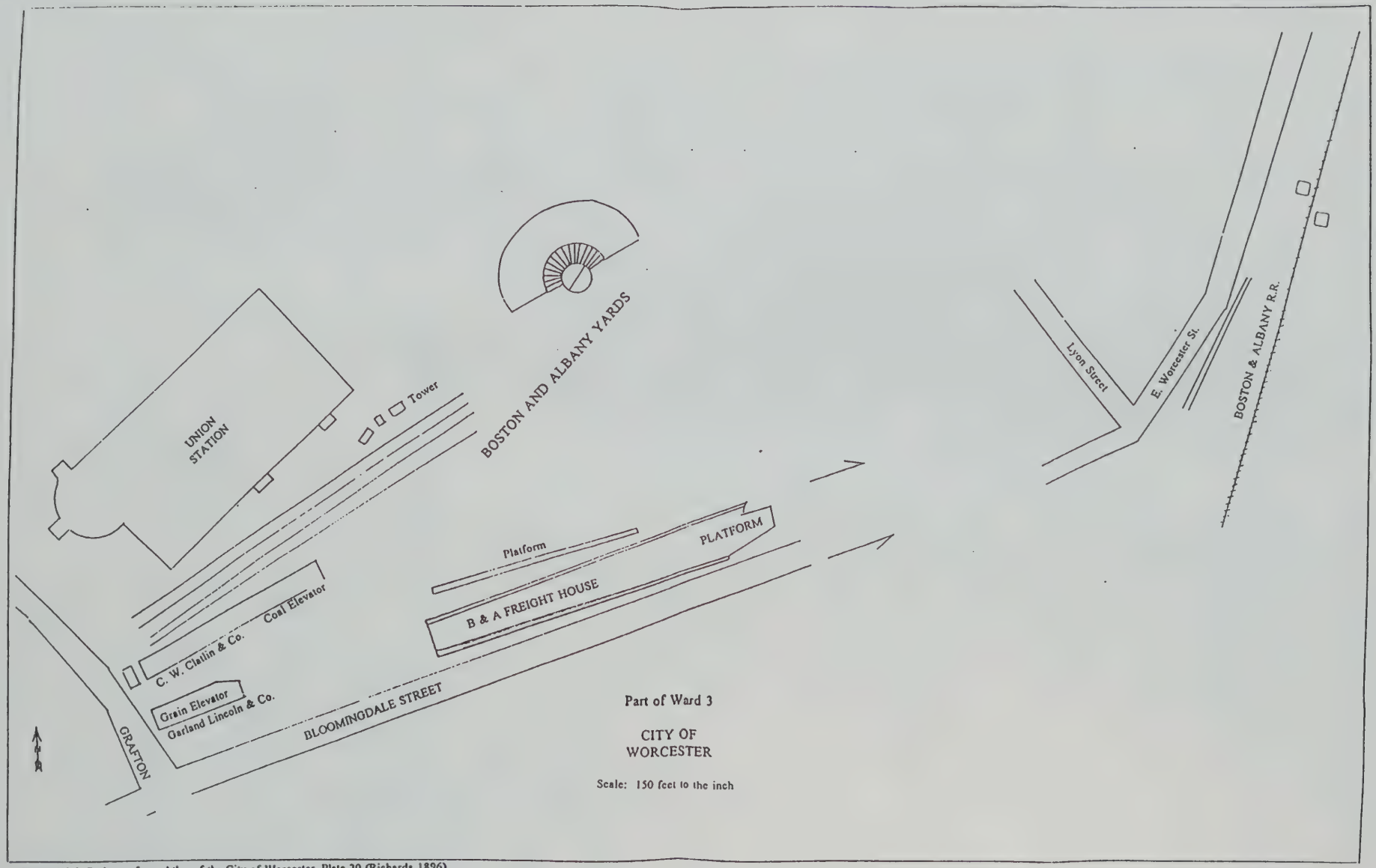


Figure IV-6 Redrawn from Atlas of the City of Worcester, Plate 20 (Richards 1896).

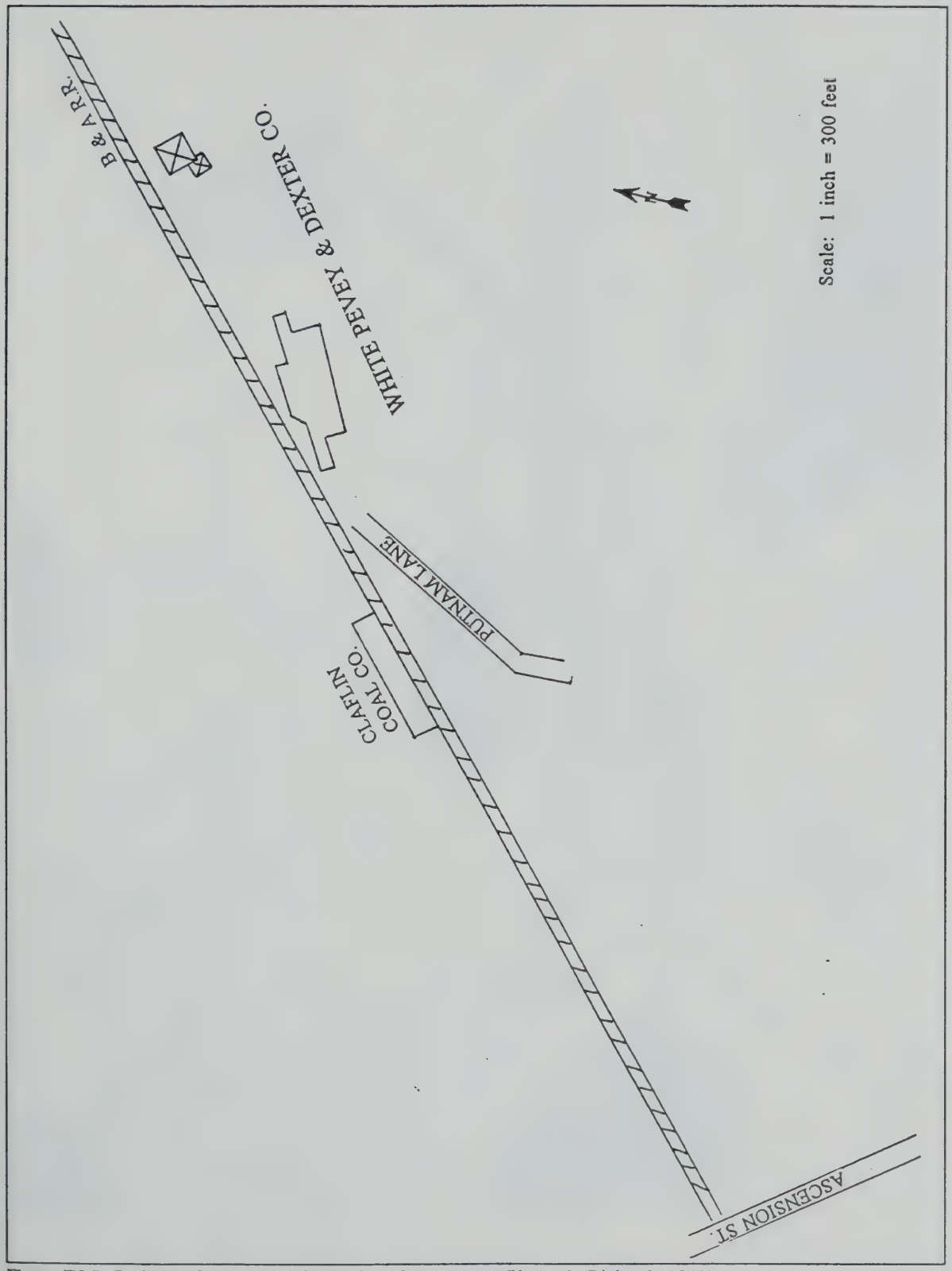


Figure IV-7 Redrawn from Atlas of the City of Worcester, Plate 20 (Richards 1922).

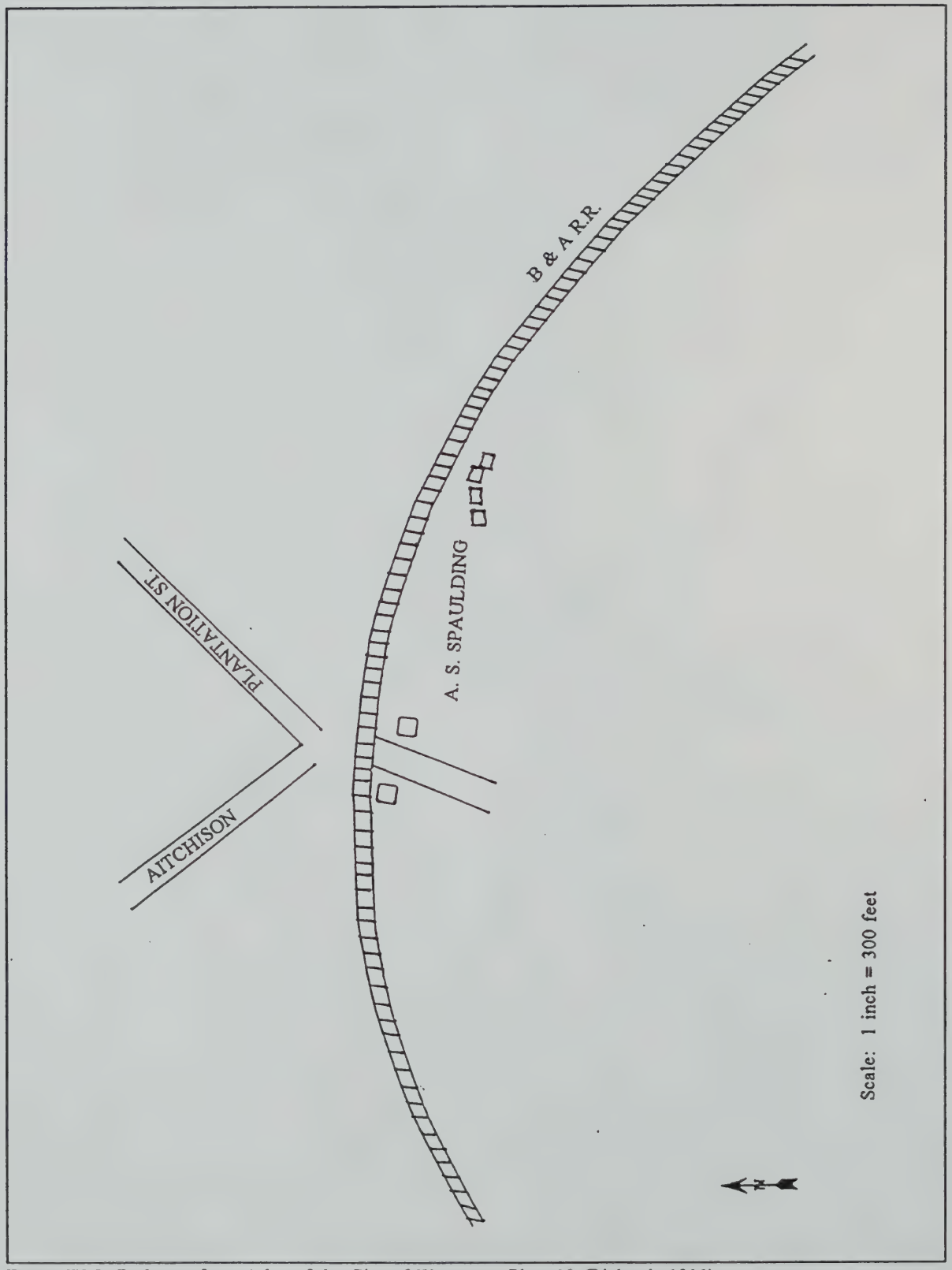


Figure IV-8 Redrawn from Atlas of the City of Worcester, Plate 19 (Richards 1911).

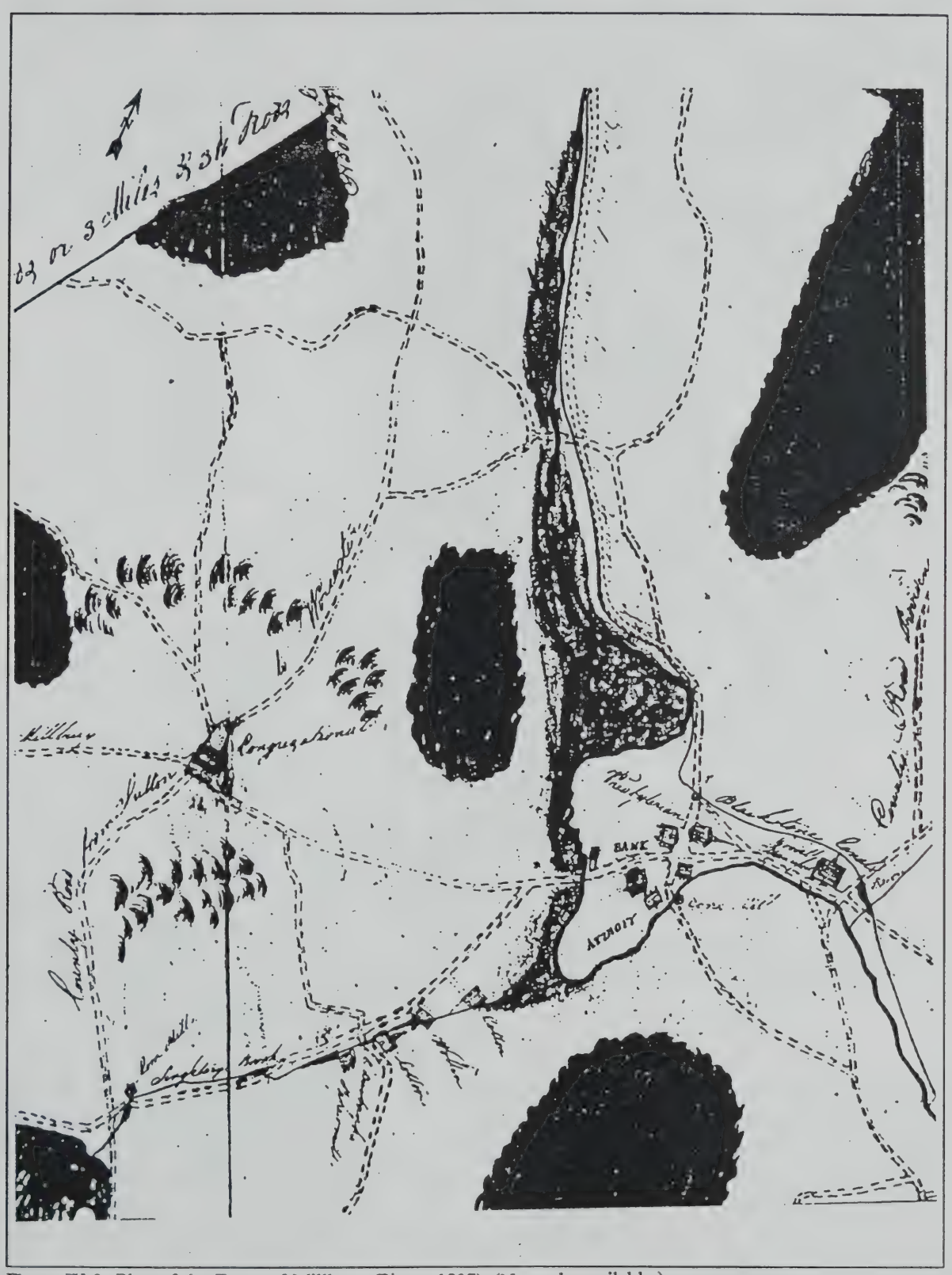


Figure IV-9 Plan of the Town of Millbury (Pierce 1837). (No scale available.)

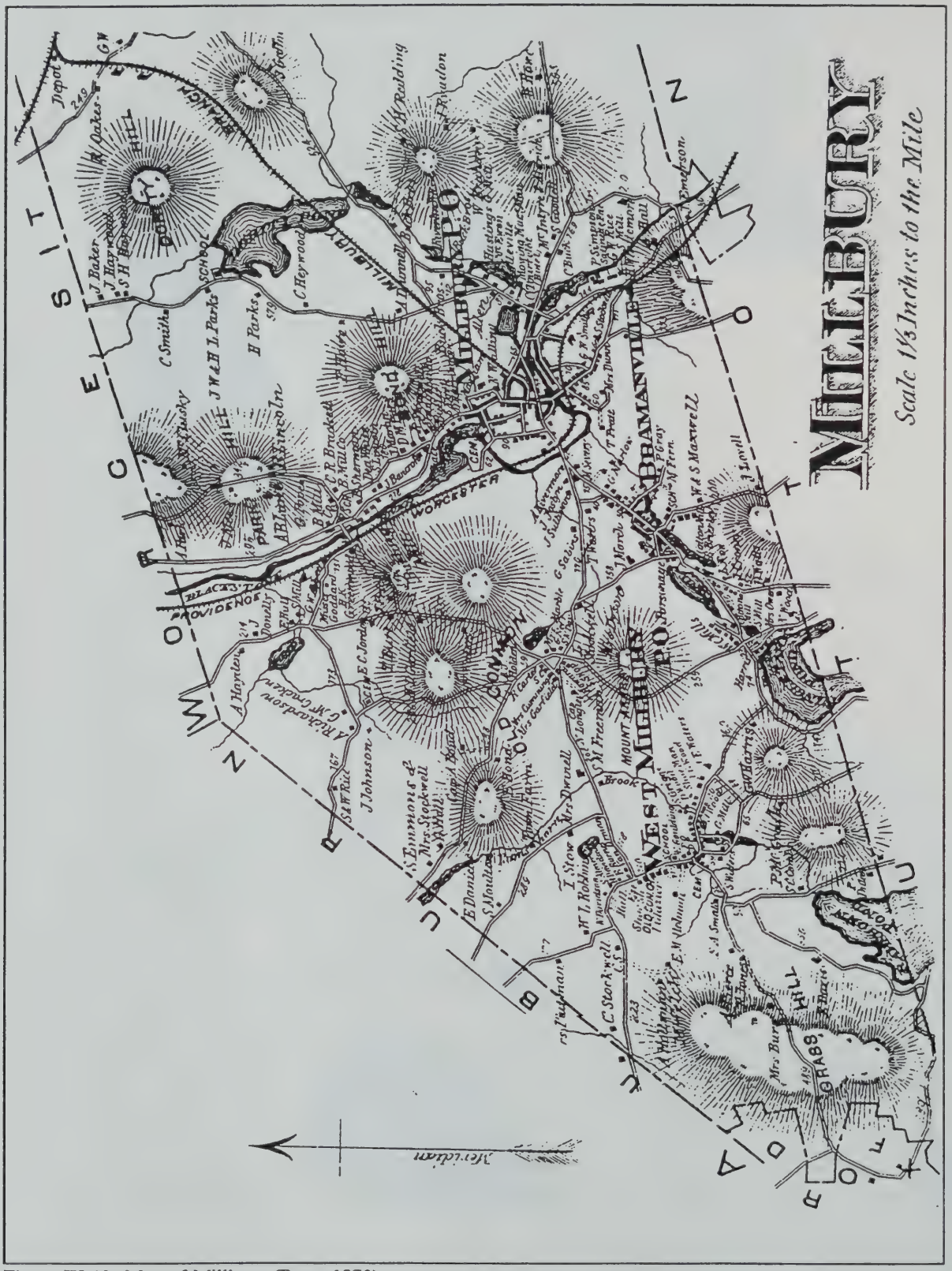


Figure IV-10 Map of Millbury (Beers 1870).

By the later part of the nineteenth century, a second manufacturing center had developed around Singletary Brook in the Bramanville area of Millbury (Fig. IV-10). Contemporary industries indicate the Burbank Paper Mill, the Braman Cotton Company Mill, Leband and Sabin textile manufacturers, Waters and Godell woolen mills, and the Waters cotton thread mill in this location (Massachusetts Historical Commission 1989:9). A somewhat smaller industrial village developed in West Millbury around Ramshorn Brook and Ramshorn Pond, where tanning and shoe making were added to existing grist and sawmilling (Massachusetts Historical Commission 1989:9, Fig. IV-10). Towards the end of the century, the town contained its own cemetery, school, and town hall (Fig. IV-10).

Thus development within the town of Millbury essentially bypassed the project area at the extreme northeastern boundary of the town. The entire focus of industrial and residential development occurred along the water routes and overland trails used by the first colonial settlers. As shown in Figure 10, by 1870 the only structure along the rail line was the depot at the junction of the Boston and Albany line and the local Millbury Branch Railroad. By 1878, two structures appear in connection with the rail line: a "passenger station" and a "depot" (Fig. IV-11and IV-12). Upgrading and widening town and state roads improved the routes from Worcester to Providence, from Worcester to Grafton and from Worcester to Sutton in the twentieth century. All these routes traversed the town south of the project area, further isolating the northeast portion of the town (Massachusetts Historical Commission 1989:16).

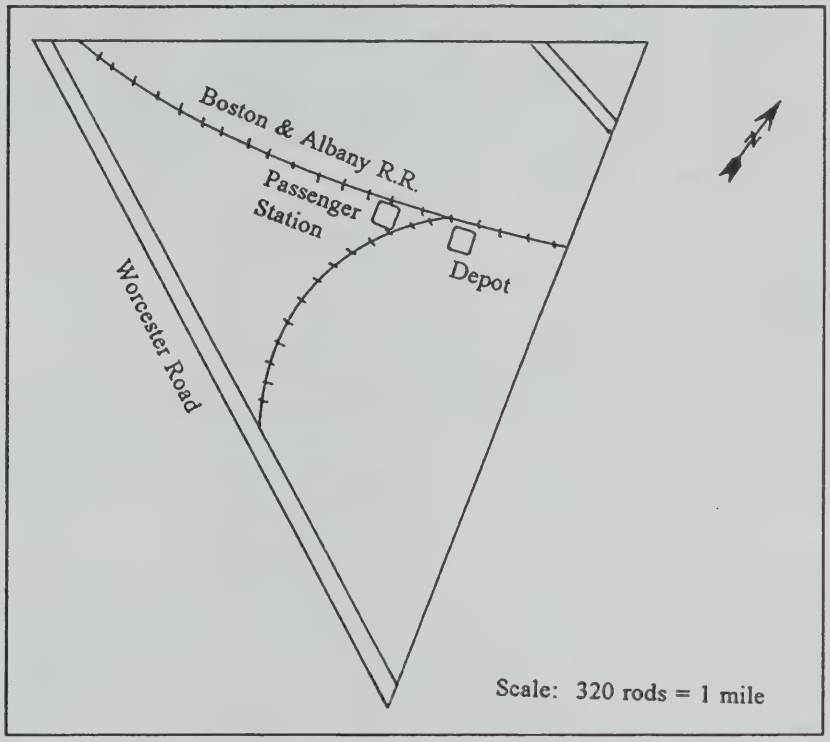


Figure IV-11 Redrawn from Map of the Town of Millbury and Villages of Millbury, West Millbury and Bramanville (New York Publishing House, 1878).

D. Grafton

The town of Grafton was established in 1735, and additional lands were annexed from Sutton in 1737, from Sutton and Shrewsbury in 1826, from Sutton in 1842, and from Shrewsbury, Worcester and Westborough in 1907 (Pierce 1879:34-37; Massachusetts Historical Commission 1984a:1). A small portion of land remains in Nipmuc ownership; a historic marker notes that Nipmuc peoples have never sold a portion of their lands on Brigham Hill Road. A second marker notes the Nipmuc burial ground on Rte. 122 south of the town center, which has been used since the late seventeenth century (Pierce 1879:318).

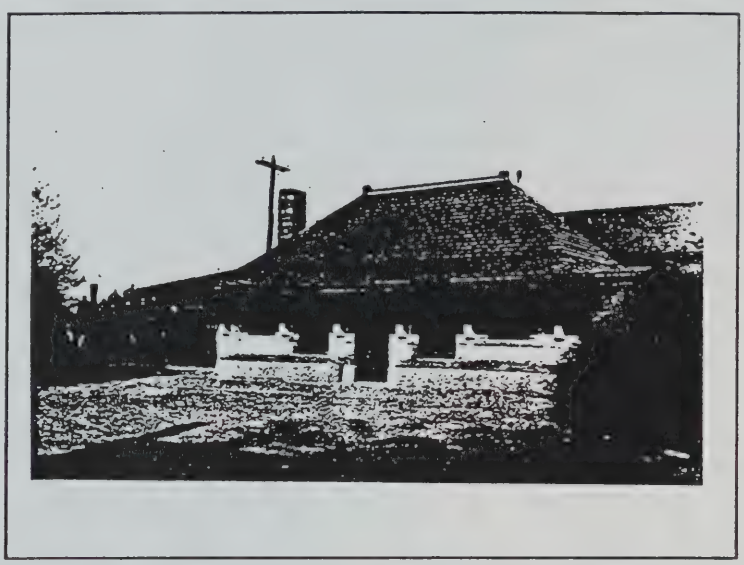


Figure IV-12 The Boston and Albany Railroad Station (Town of Millbury 1915).

The colonial town center developed around Chestnut Hill (Assawossachuasuck). The town common was laid out in 1728, the first meeting house was erected in 1730, and the schoolhouse in the following year. An early mill operated in the area near Moses Printer's land and Lieutenant Brigham's meadow. This may be the area known today as Brigham Hill, near the reserved Nipmuc lands and close to Goddard Pond (Pierce 1879:62; Massachusetts Historical Commission 1984a:1). The Worcester-to-Providence road intersected the Boston-to-Connecticut road and a road from Worcester to the southeast at the center of Grafton (Massachusetts Historical Commission 1984a:1). The town center prospered during the Federal period, and included farmhouse clusters along Pleasant Street, along George Hill Road and Leland Street, and along Silver Lake and Sibley Street (Massachusetts Historical Commission 1984a:6). Early industries included potash-making and the manufacture of shoes and boots (Pierce 1879:309). Developments in animal husbandry supported a leather-tanning industry and the currying trade early in the nineteenth century (Massachusetts Historical Commission 1984a:6).

Although the town center was developing along early transportation routes, the attraction of water sources for industry stimulated the growth of additional settlement centers. The opening of the Blackstone Canal in 1828 caused rapid growth in Farnumsville and Saundersville southwest of the village center (Fig. IV-13). Between 1831 and 1835, 4,806 tons of raw materials were shipped into these villages, and 951 tons of agricultural and manufactured products were transported therefrom (Pierce 1879:320). Industrial development also concentrated in the area of New England Village as shown in Figure IV-13. The first textile mill, manufacturing twines and bagging , was established at the upper falls of the Quinsigamond River by 1826 (Massachusetts Historical Commission 1984a:7). By 1831, the Quinsigamond River had been dammed by Irish Dam at Flint's Pond, and Hovey Dam at Hovey Pond, and a second mill was erected at the lower privilege in the river (Massachusetts Historical Commission 1984a:7). Figure IV-13 also shows a variety of mill-related structures, including mill stores, mill counting rooms, an engine house and a blacksmith's shop; the area also held tenement housing, schools, churches, and a post office.

The opening of the Boston and Albany Railroad did not stimulate industrial growth in Grafton to the same degree evident in Westborough and Southborough. Relatively few structures -- notably the Grafton Station, the J.S. Nelson Shoe Factory, and an engine house (Fig. IV-13) -- emerged along the track during its first half century. Built in 1848, the Nelson Shoe Factory's location does not appear to be an immediate consequence of the 1831 railroad (Pierce 1879:359). By the end of the century, however, more structures had been erected along or near the railroad. Richards' 1898 map indicates two factories in the vicinity of the train tracks: the Bay State Ice Company sat on a rail spur near the Millbury town line, while south of the train station, close to

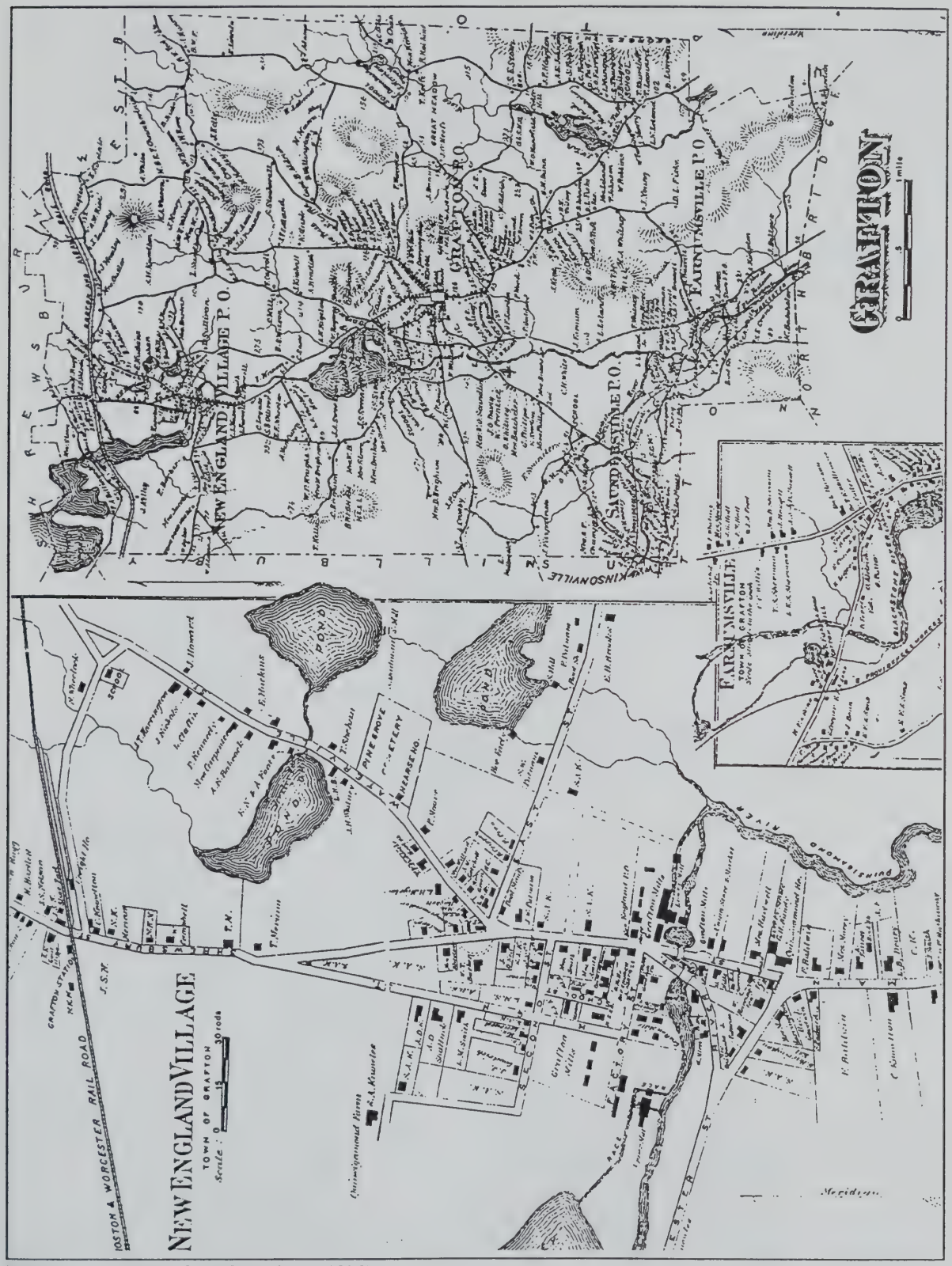


Figure IV-13 Map of Grafton (Beers 1870).

the Westborough boundary, was a shoelace manufacturer. Additional structures included the Westborough Savings Bank, immediately south of the tracks on Oak Street, and some railroad-related structures, such as a storage shed, a freight house, and a coal shed. The town's water tower was located just south of the station, at the junction of Oak Street; all the remaining structures were private dwelling houses. The Worcester State Asylum (known as the Grafton State Hospital after 1915) contained a complex of buildings constructed in 1877, somewhat north of the railroad.

The greatest changes in the town's twentieth-century topography occurred outside the project area, in Farnumsville. Here residential growth took place along Cross Street and east of the mill (Massachusetts Historical Commission 1984a:18). The center of town has changed little since the nineteenth century and is considered one of the best-preserved villages in central Massachusetts (Massachusetts Historical Commission 1984a:2). While Wyman-Gordon Manufacturing provided a new industrial focus northwest of the town center, North Grafton saw only a more intensive in-filling of existing residential and commercial areas (Massachusetts Historical Commission 1984a:18). The project corridor thus retains essentially the same characteristics evident on nineteenth-century maps.

E. Westborough

The first land grant in the town was made to Charles Chauncy in 1659, in the form of a payment from the Massachusetts General Court. This land was annexed to Marlborough the following year when that town incorporated. Additional grants in Westborough were made in 1677, 1680 and 1686. Initial settlement followed the Connecticut Path and included the homes of David Warren, Perez Rise, Eli Whitney and the Fay family. The town was incorporated in 1717, and annexed additional lands from Sutton in 1728, from Upton in 1754, and from Shrewsbury in 1762 (Allen 1984:15-23). Early structures, including the first meeting house, were concentrated in the area of Milk Street. The junction of Main and Milk streets and a portion of East Main Street, became important later in the eighteenth century as the location of the burying ground, a second meeting house and dispersed farms (Massachusetts Historical Commission 1983b:3).

In the decades following the completion of the Boston and Worcester Turnpike, which entered Westborough in 1810, several businesses sprang up to take advantage of the new transportation route (Fig. IV-14). First among these new businesses was Silas Wesson's 1825 tavern at the corner of the Turnpike and Park Street (to the north and west of the project area, and southwest of Chauncy Pond). In the 1820s, Nathan Fisher built a house and shop to the east of the Wesson Tavern. Fisher later constructed a thread factory, the first manufactory to use steam power in Westborough. Other homes and businesses followed, and by 1837 the area boasted its own schoolhouse. Soon "Wessonville" rivalled the town center as the focus of business and industry in Westborough (Allen 1984:32).

The Piccadilly area of Westborough (south and west of the project area near Morse, Belknap and Hopkinton streets) was a second area of concentrated growth, outside the town center. As shown in Figure IV-14, a series of mills, machine shops, stores and elegant residences created a thriving community in the early nineteenth century. This portion of Westborough benefitted from its proximity to Piccadilly Brook, which powered the mills. The social and economic power of Piccadilly placed it in competition with Wessonville and the town square as the locus of civil influence in the town of Westborough.

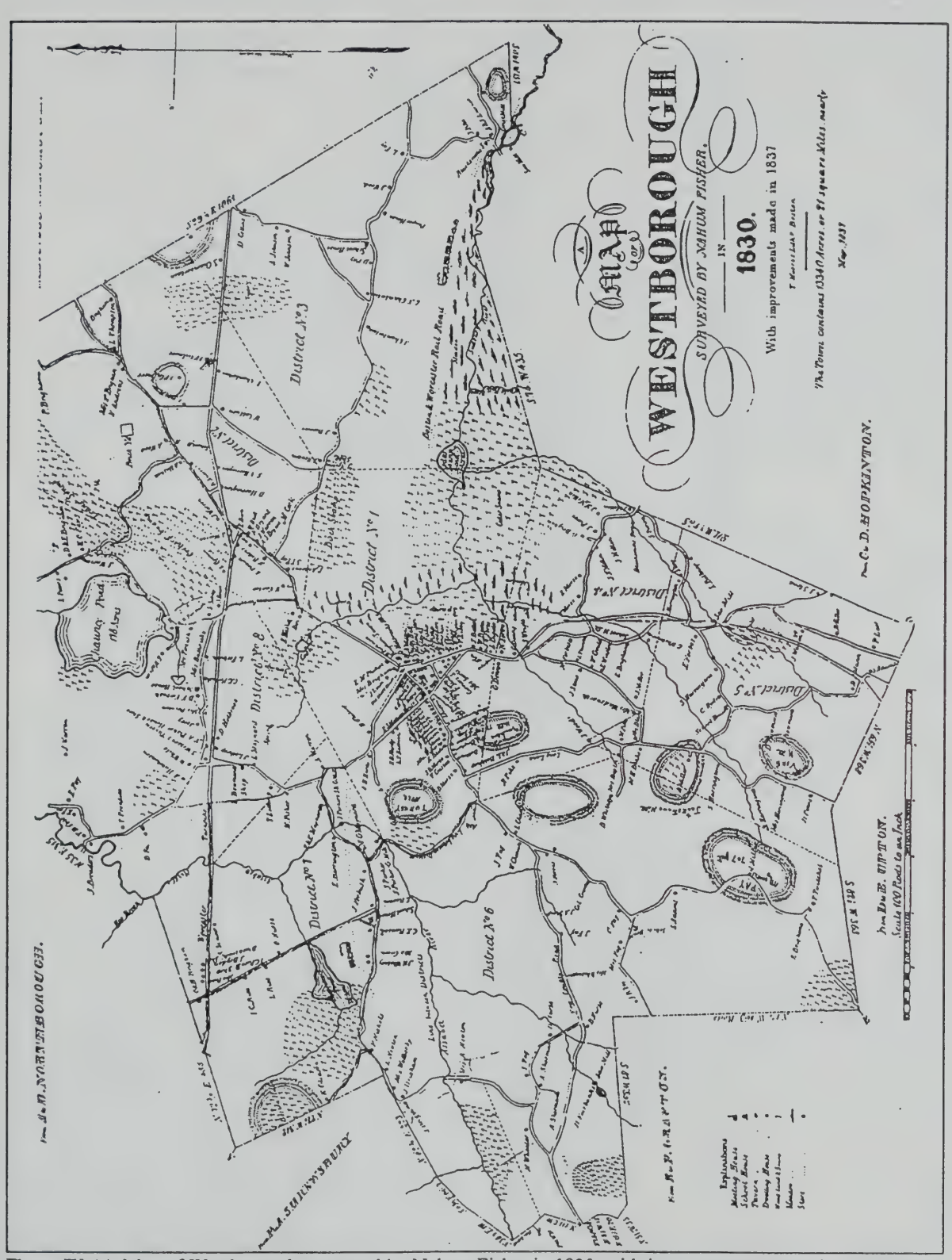


Figure IV-14 Map of Westborough, surveyed by Nahum Fisher in 1830, with improvements made in 1837 (Fisher 1837).

Although not forming a village center, such as Piccadilly or Wessonville, a small industrial area also grew up at the junction of Fruit Street and Old Flanders Road across from the Sudbury River. Early maps reveal a blacksmith shop, a sawmill, and a grist mill in this location, and by 1870 the area contained a grist and plaster mill (Fig. IV-15; Allen 1984:36). This area is within the WCRE project corridor.

The entrance of the railroad into Westborough in 1834 shifted institutional and industrial power back to Main Street and the town square (Allen 1984:32). The village center reemerged as the town's economic base, with commercial, industrial and institutional strength drawn from market access for agricultural products. Westborough milk and cheeses were transported to Boston, in addition to apples from its orchards and pork from its pig farms (Massachusetts Historical Commission 1983b:7). Furthermore, the railroad allowed nineteenth-century manufacturers of straw hats, boots, sleighs, and bicycles to acquire raw materials and transport finished products throughout the country (Allen 1984:54). In facilitating the transportation needs of early industry, the railroad influenced the location of hotels and taverns, much as the turnpike had done two decades earlier. Brigham's Tavern, the Westboro Hotel, the Whitney House, Brown's Livery Stable and Ford's Livery Stable all catered to train passengers, and their location was in direct response to the location of the train depot (Allen 1984:57).

The link between railroad location and social and economic institutions is particularly interesting in Westborough. The Boston and Albany railroad tracks originally entered Westborough from Cedar Swamp in the east, and ran parallel to Railroad Street, crossing Main Street at the center of town, and exiting to the west along Milk Street (Fig. IV-16). Because the tracks ran immediately south of the meeting house, which was located at the corner of Main and Summer streets, the town elected to change the meeting house's location. In 1837, the tower and bell were taken down from the building, and the structure became a shopping arcade (Allen 1984:56).

In the mid nineteenth century, a new schoolhouse was constructed on High Street so that children in the Grove Street school catchment area would not have to cross the busy railroad tracks in their journeys to and from school (Allen 1984:57). The train station was also moved from its former location on Brigham Street (Railroad Street) to its current situation on East Main Street in order to straighten the tracks and increase the train's speed (Figs. IV-17 and IV-18). The tracks were also straightened and elevated where the line crossed the center of town. (The new orientation is overlaid on the 1870 Beers map, Fig. IV-16). To mollify the fears of local businessmen, rail spurs serviced the freight depot on Brigham Street and sidings ran to factories on Brigham, Union, Beach and Milk streets. Bay State Abrasives was such a profitable freight customer than the company extended tracks into the factory yard (Allen 1984:58). By the end of the nineteenth century, the railroad was firmly embedded in Westborough's economic fabric. The dairy farm of C. Brigham was recognized as the largest milk company in the world by 1890. The Bartlett Box Co. manufactured boxes used by the railroad to ship raw materials and manufactured products to markets. Armour & Co. operated a refrigerated warehouse to store meat prior to shipment. From 1914 to 1969, the Westborough Tannery used the railroad system to import sheepskins from New Zealand and Scotland, and kangaroo skins from Australia.

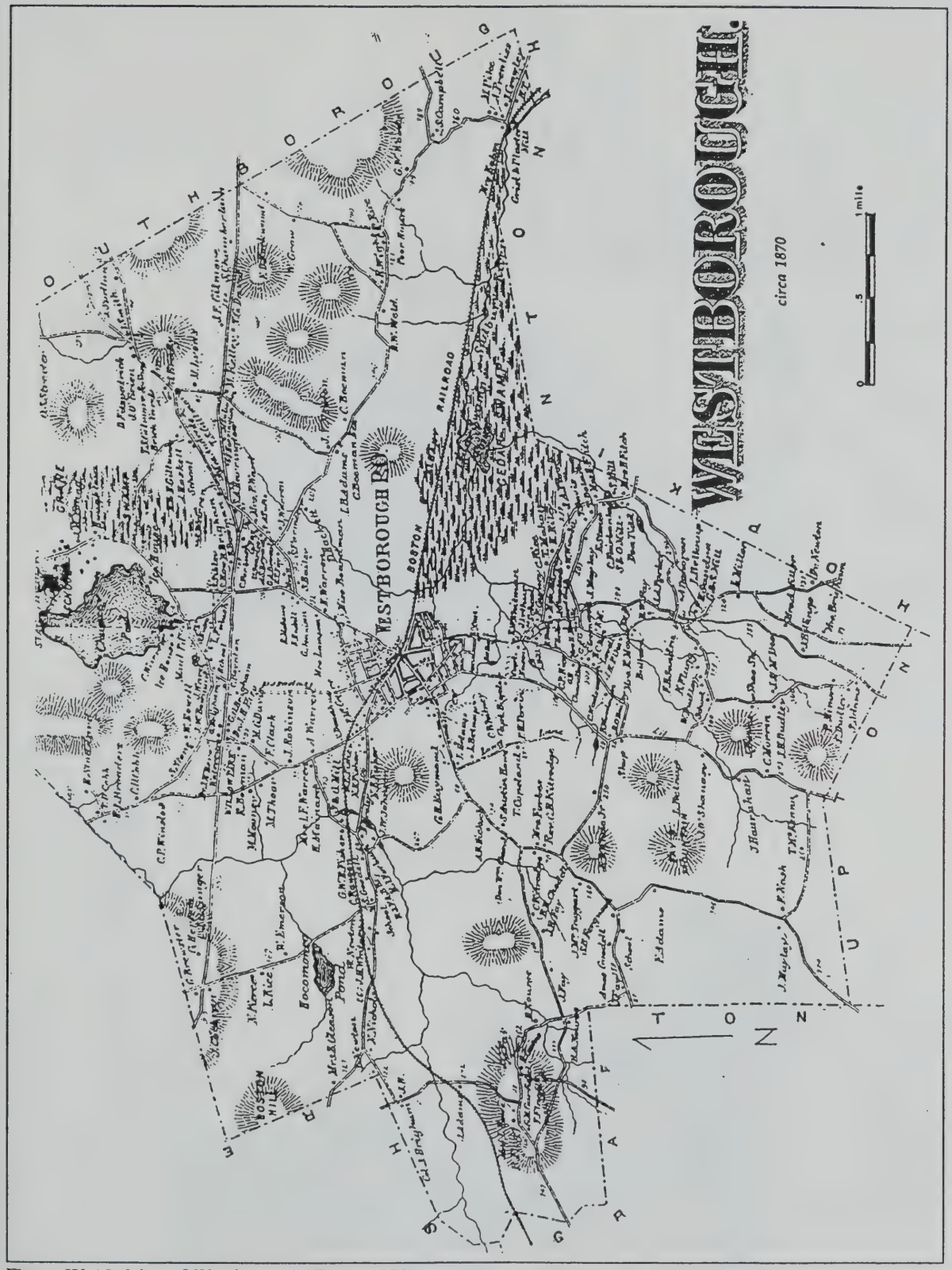


Figure IV-15 Map of Westborough (Beers 1870).

WESTBOROUGH
Westborough
Business Notices.
Attorney.
Bank.
Hotel.
Editor.
Physicians.
Dentists.
Blacksmiths.
Livery Stable.
Carpenters and Builders.
Bryant Geo A..Carpenter and Joiner
Brown A. B..Carpenter and Joiner
Bowker A. B..Carpenter and Joiner
Feather D. B..Res Phillips st
Forbush J. E..Res cor Mill and Grove sts
Hathaway Geo..Res Cor Main st
Hartshorn Geo..Carpenter and Joiner. Res cor Flanders and Cross sts
Harrington R. A..Mason
Hickok A. E..Carpenter and Joiner and Farmer
McKeedy G. A..Carpenter and Cabinet Maker. Res Bowker st
Newton E. J..Building Mover
Rice C. A..Carpenter and Joiner. Res Boardman st
Sargent J. M..Carpenter and Manufr of Boxes, Res Bowker st
Sabin W. O..Carpenter and Joiner. Res South st
Squier S. P..Carpenter and Joiner. Res Mill st
Hose J. W..Farmer
Hose D. A..Farmer
Long L. B..Engineer at "Kimball's Boot Factry"
Long Chas..Res Main st
Long W. B..Boot Finisher, Office st
Long Chas. E..Boot Finisher
Morse W. F..Res California st
Mullinger Wm..Gardener, cor Main and California sts
Norton J. W..Farmer
Norton W..Farmer
O'Brien Jas..Farmer
Parker O. W..Butcher and Boarding House Keeper, South st
Perry F. E..Mechanic, cor Church and Green sts
Porter F. E..Nurseryman and Florist
Parmenter Geo. H..Farmer, Main st
Rexwill W..Milk Dealer
Robinson A..Farmer
Rice J. W..Mechanic, Parkman st
Riley J..Mechanic
Everett O. N..Farmer
Stoddard R..Farmer
Staples J..Farmer
Thayer E..Boot Finisher at "Kimball's Boot Factry"
Wheeler A. M. L..Prop of Saloon, "Horse Block"
Wood Lorenzo..Shoe Clerk
Whitney E. H..Hostler at "Bullard & Davis' Stable"
Warren C..Farmer
Warren O..Farmer
Winslow C. P..Farmer
Weld H. W..Farmer
Whitman E. W..Farmer and Butcher
Wadsworth O..Farmer and Dealer in Wood and Lumber
Wadsworth B..Teamster, Harrison ave
White E. D. Jr..Farmer
Young J. M..Farmer
Miss Burlingame
Miss Bordwell
Mr. Bullard
Mr. Brown
Mr. Kimball
Mr. Hall
Mr. Hayes
Mr. Hunt
Mr. Wood
Mr. Bowker
Mr. Fisher
Mr. Hartshorn
Mr. Hickok
Mr. Newton
Mr. Rice
Mr. Sargent
Mr. Sabin
Mr. Squier
Mr. Hose
Mr. Long
Mr. Morse
Mr. Norton
Mr. Parker
Mr. Perry
Mr. Rexwill
Mr. Robinson
Mr. Riley
Mr. Everett
Mr. Stoddard
Mr. Staples
Mr. Thayer
Mr. Wheeler
Mr. Wood
Mr. Whitney
Mr. Warren
Mr. Winslow
Mr. Weld
Mr. Whitman
Mr. Wadsworth
Mr. White
Mr. Young
Mr. Stone
Mr. Ruggles
Mr. Parkman
Mr. Grover
Mr. Hill
Mr. Ward
Mr. Bullard
Mr. Davis
Mr. Ellis
Mr. Cross
Mr. Flanders
Mr. Cook
Mr. Fay
Mr. Harrington
Mr. Hartshorn
Mr. Hickok
Mr. Newton
Mr. Rice
Mr. Sargent
Mr. Sabin
Mr. Squier
Mr. Feather
Mr. Forbush
Mr. Hathaway
Mr. Hartshorn
Mr. Harrington
Mr. Hickok
Mr. McKeedy
Mr. Newton
Mr. Rice
Mr. Sargent
Mr. Sabin
Mr. Squier
Mr. Brown
Mr. Bowker
Mr. Bryant

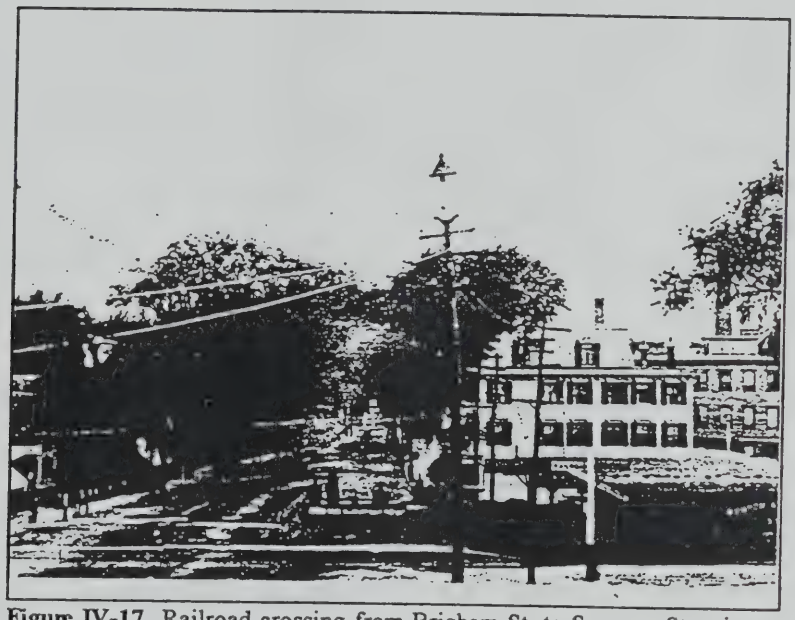


Figure IV-17 Railroad crossing from Brigham St. to Summer St. prior to 1899, facing west (Allen 1984:55).

Figure IV-18 Steam locomotive at present Wetborough Depot, c. 1900, facing east (Allen 1984:55).

F. Southborough

Originally part of Marlborough, Southborough was incorporated as a town in 1727, with additional lands annexed from Framingham in 1786 and Marlborough in 1843 (Massachusetts Historical Commission 1983a:1). Early development was concentrated to the north of the project area along Stony Brook, at the junction of today's Main Street and Rte. 85 (Fig. IV-19). Original mill sites were located along Stony Brook and Angel Brook, which were subsequently flooded during the development of Boston's metropolitan water supply system (Massachusetts Historical Commission 1983a:1). The entrance of the Boston-to-Worcester Turnpike into Southborough in 1810 had no immediate influence on the town, although later in the century the village of Fayville developed around the intersection of the Turnpike, Central Street and Oak Hill Road. Fayville contained homes, stores, a church, and a school and later became an important manufacturing area, containing boot, shoe, bonnet, brush and brick factories. Whiting Patent Brushes, which operated in Fayville from 1841 to 1850 before moving to Boston, was one of the most important businesses of the era (Beers 1870; Massachusetts Historical Commission 1983a:5,6).

The Boston and Albany Railroad reached Southborough by 1834, and fairly soon stimulated industrial development along the Sudbury River in the Southville and Cordaville sections of town (Figs. IV-20 and IV-21). J. Hartt & Co. erected a shoe factory at the junction of the rail line and Main Street, and W.B. Wood owned a series of buildings in the vicinity of the pond at the end of Wood Street. One of these buildings is identified as a satinette factory that manufactured cloth from cotton and wool (Fig. IV-21). By the end of the century, residences surrounded the Southville rail depot, which was razed in 1977 (Noble 1990:336). Bailey's (1887) panoramic view of Southborough provides an excellent plan of late nineteenth-century structures in Southville.

In Cordaville, the link between industrial growth and the railroad was closely associated with one individual. Milton Sanford began construction in 1846 of a large stone mill, designed to manufacture cotton and woolen goods. In addition to the mill, Sanford constructed a company store and residences to house factory workers (Figs. IV-22 and IV-23; Noble 1990:148). Within a year, a mill village existed along the rail line and around a large pond in the Sudbury River. By 1849, the company was incorporated as the Cordaville Manufacturing Company (Massachusetts Historical Commission 1983a:6; Noble 1990:148). Fire destroyed the mill in 1855, but Sanford constructed a replacement factory in the location of the original buildings, where he manufactured wool fabrics and jute blankets. During the Civil War, Sanford supplied his jute blankets to the Union Army (Noble 1990:174-175). At an auction in 1928, the site consisted of "two large factories of stone and brick, one four stories and the other three stories in height, two storehouses, and an office building and power plant..." (Stone 1930:1944). According to Richards' 1898 map (Fig. IV-22) the village also contained a train depot, a creamery, and a jail. In 1970, the Cordaville train depot was dismantled and moved to Dublin, New Hampshire, where it became the public library (Noble 1990:336).

G. Ashland

Colonial settlement began after 1700 and consisted of isolated farms scattered along the Sudbury River with no early focal point (Massachusetts Historical Commission 1980a:3). By 1818, the village center contained only one mill, one rowhouse and three additional dwellings (Massachusetts Historical Commission 1980a:3). The village of Ashland was incorporated as a town in 1846 from parts of Framingham, Holliston and Hopkinton (Massachusetts Historical Commission 1980a:1).

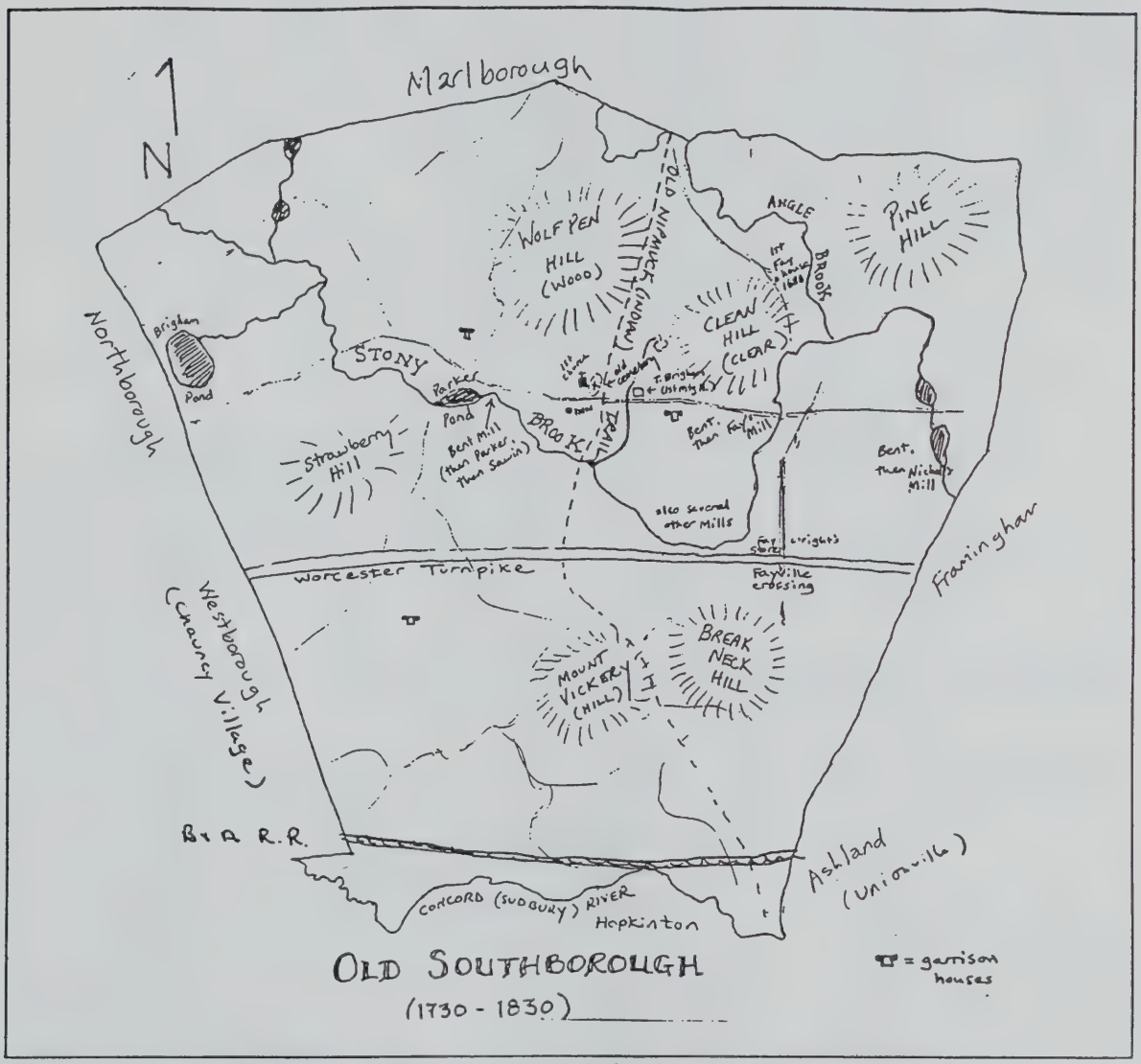


Figure IV-19 Old Southborough (1730-1830) (Noble 1990; frontispage). (No scale available.)

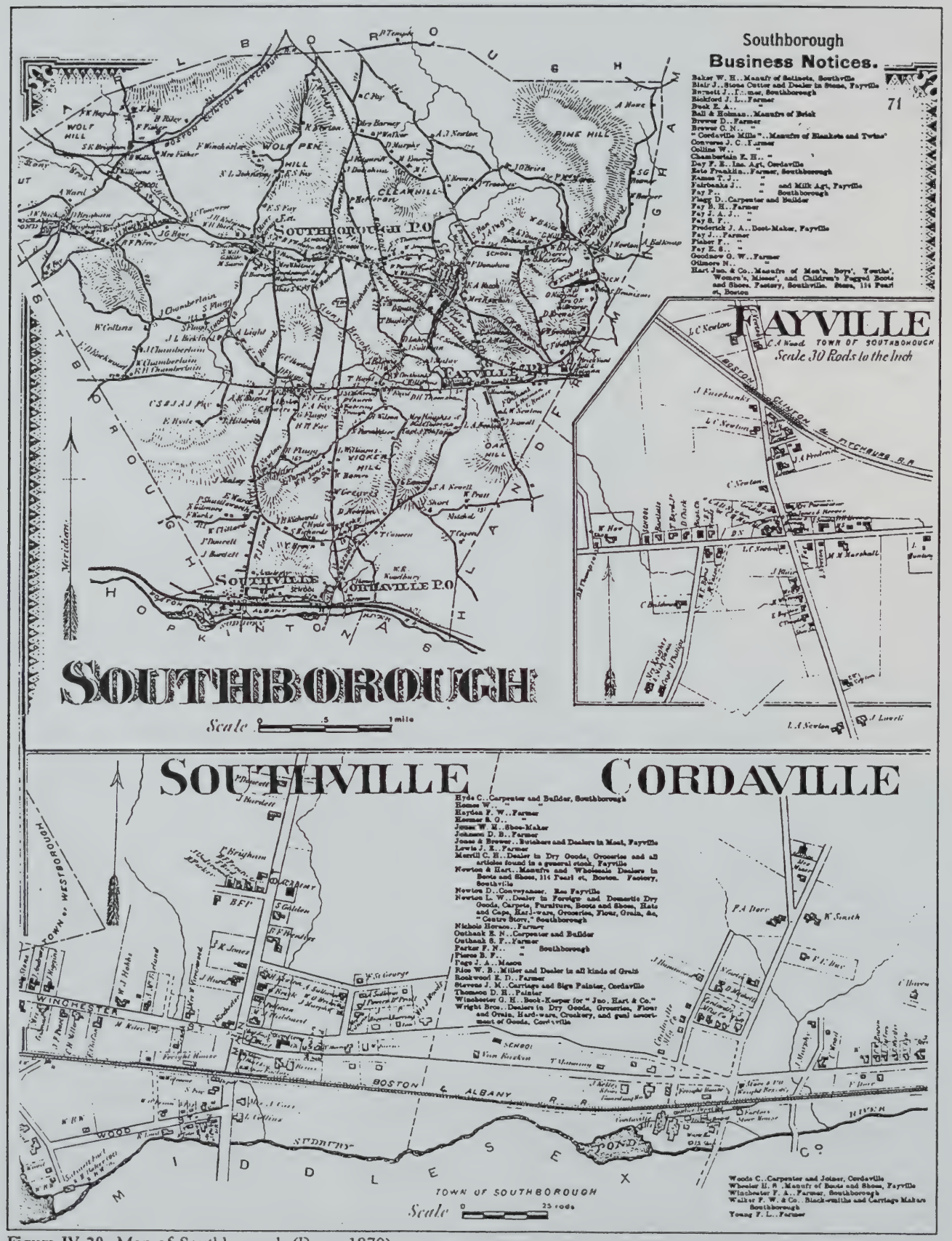


Figure IV-20 Map of Southborough (Beers 1870).

SOUTHVILLE
CORDAVILLE
Elde C. Carpenter and Builder, Southborough
Hayden F. W. " "
Hayden F. W. . . Farmer
Hosmer R. O. . . "
Jones W. H. . Shoe-Maker
Johnson D. B. . Farmer
Jones & Brewer. . Butchers and Dealers in Meat, Fayrville
Lewis J. E. . Farmer
Merrill C. H. . Dealer in Dry Goods, Groceries and all articles usual in a general stock, Fayrville
Newton & Hart. . Manufs. and Wholesale Dealers in Boots and Shoes, 111 Pearl st, Boston. Factory, Southville
Newton D. . Conveyancer. Res Fayrville
Newton L. W. . Dealer in Foreign and Domestic Dry Goods, Carpets, Furniture, Boots and Shoes, Hats and Caps, Hardware, Groceries, Flour, Grain, &c, "Centre Store," Southborough
Nichols Horace. . Farmer
Oulbank E. N. . Carpenter and Builder
Oulbank S. F. . Farmer
Parker F. N. . . " Southborough
Pierce B. F. . . "
Rice W. B. . Mason
Rice W. B. . Miller and Dealer in all kinds of Grain
Rockwood E. D. . Farmer
Stevens J. M. . Carriage and Sign Painter, Cordaville
Thomson D. H. . Painter
Winchester O. H. . Book-Keeper for "Jno. Hart & Co."
Wright Bros. . Dealers in Dry Goods, Groceries, Flour and Grain, Hardware, Crockery, and general assortment of Goods, Cordaville
Woods C. . Carpenter and Joiner, Cordaville
Wheeler H. S. . Manufr of Boots and Shoes, Fayrville
Winchester F. A. . Farmer, Southborough
Walker F. W. & Co. . Black-smiths and Carriage Makers, Southborough
Young F. L. . Farmer
TOWN OF SOUTHBOROUGH
Scale
0
25 rods
BOSTON & ALBANY
SCHOOL
Van Buskirk
T. Manning
Miller Store
Bourbeuse
Cordaville
POND
SUDBURY
RIVER
MIDDLESEX
CO.
WINCHESTER
TOWN OF WESTBOROUGH
Freight House
Cemetery Site
Illuminating
Cordaville Mills
Wright Bros
Store House
Freight House
Cordaville
Fulton
Wagons
Stable
Wagons
Stable
Wagons
Stable

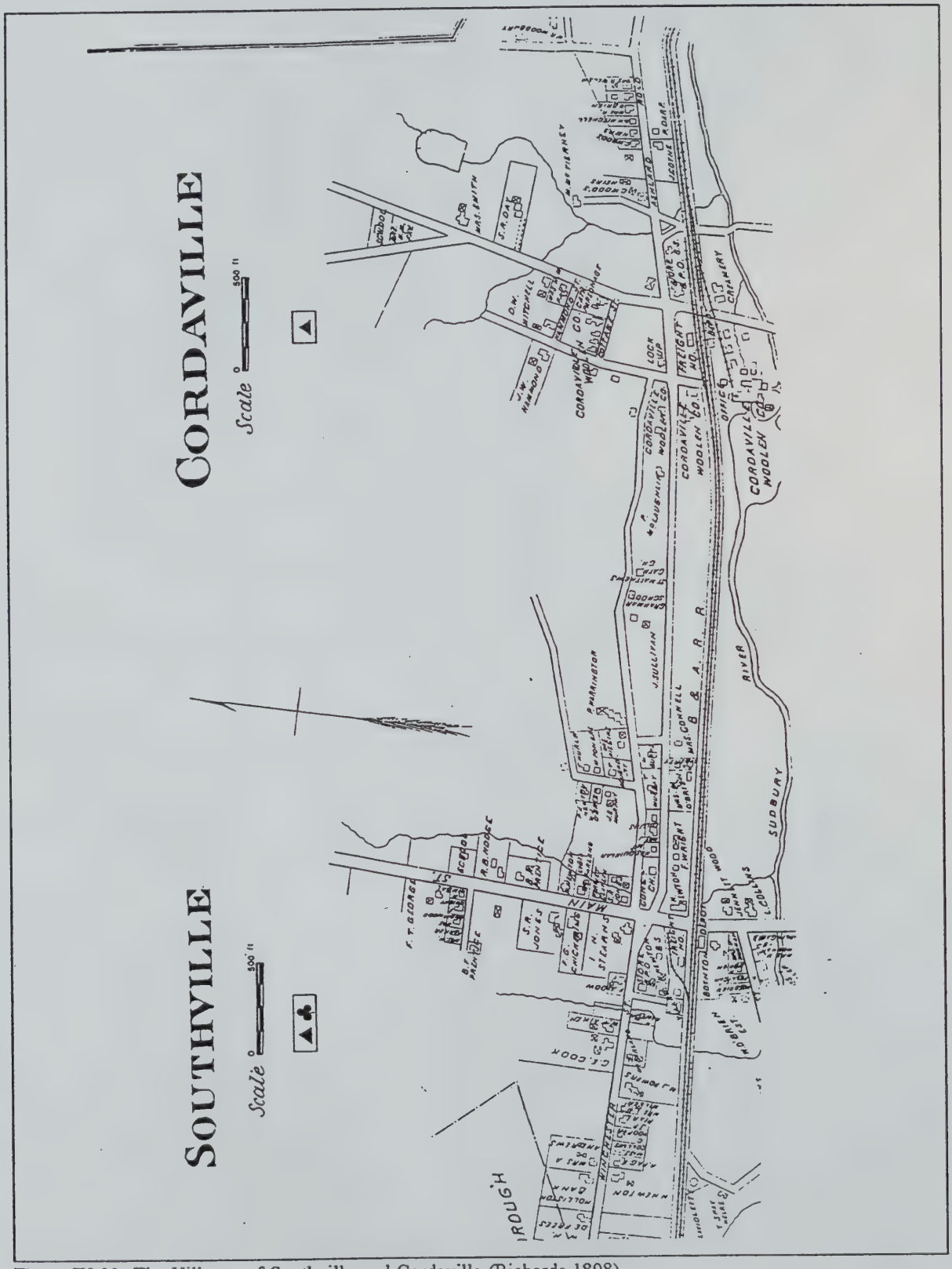


Figure IV-22 The Villages of Southville and Cordaville (Richards 1898).

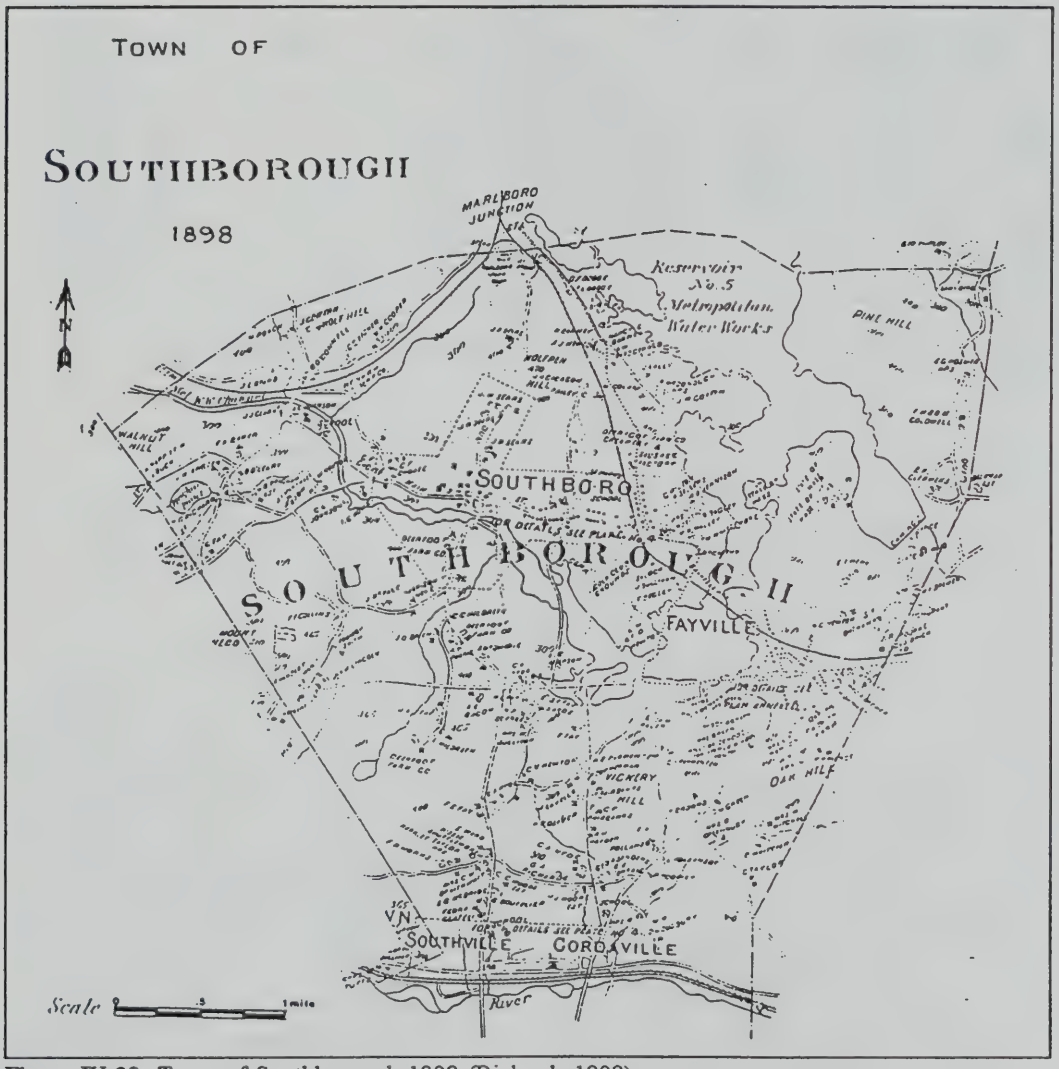


Figure IV-23 Town of Southborough 1898 (Richards 1898).

The distribution of streams such as Indian Brook and Cold Spring Brook dictated the location of some early industrial sites to the south of the Sudbury River, and several mill sites were later submerged during the creation of the metropolitan reservoir system (Works Progress Administration 1942:68-69). One major industrial area centered on the 1795 mill site of Colonel John Jones. Located at the center of the village, the location contained grist, saw-, and fulling mills; a cotton mill was in operation by 1815. The Dwight Print Company eventually acquired and occupied these facilities (Massachusetts Historical Commission 1980a:4-5; Works Progress Administration 1942:68-69).

The Shepherd Mill neighborhood, at the confluence of Cold Spring Brook with the Sudbury River, housed another complex of mills on both banks of the river. This area contained a corn mill, a saw mill and a fulling mill in the early eighteenth century. The mills were later removed, however, with the construction of a large dam. Before the end of the century, a small wheel manufacturing shop operated in the area. By 1828, the new property owner constructed a paper mill that is shown as Shepherds Paper Mill on the Nixon 1832 map of Framingham. A blacksmith's shop and dwelling are also shown in this location on the 1832 map. When the property changed hands again in 1856, an emery mill was constructed. Some buildings of the Shepherd Mill neighborhood were as close as 40 yds. from the railroad bridge adjacent to Cold Spring Brook. The mill continued in operation until the area was submerged as part of the Metropolitan Water Supply (Works Progress Administration 1942:71-72).

Other early industrial sites were located along the Sudbury River. The Aldrich mills, in western Ashland, manufactured cotton textiles (Fig. IV-24), while the Bigelow Paper Mill (founded in 1817), near the intersection of Oak and Winter streets, also used water from the Sudbury. Surrounding the mill site were the palatial homes of the mill owners, mill-operated stores, and workers' row houses, which extended down to the river (Works Progress Administration 1942:69).

Despite the presence of these mills along the Sudbury River, the economic development of Ashland proceeded slowly. When the railroad arrived, only the town's hotel and a dozen or so houses were in close proximity to the station (Works Progress Administration 1942:66). The railroad did stimulate industrial, residential and mercantile growth, with new establishments springing up in the area overnight (Works Progress Administration 1942:66). One of the new buildings was a railroad station, first built in 1834-5 and replaced by an Italianate style building in 1850 and again replaced by a granite station in 1888 (Massachusetts Historical Commission 1980a:5-6). To facilitate traffic flow on existing thoroughfares crossed by the railroad, the town constructed several bridges, including the nineteenth-century steel truss bridges at Howe Street and High Street.

One of the outstanding developments in the town was the Cutler Mill site at the border of Ashland and Framingham (Fig. IV-24). Simeon Cutler's large grain business took advantage of both rail transportation and water sources when it adopted steam power and cast-iron machinery in the mid nineteenth century. The site, which contained the first grain elevator east of the Hudson River, was unfortunately part of lands condemned by the City of Boston during the development of the Metropolitan Water Supply system (Works Progress Administration 1942: 73).

The major stimulus to the economic development of Ashland came not from the railroad, but from anticipation of the business to be brought Hugh Dwight Printing Co. In addition to factory buildings and storehouses, merchants and builders opened new stores and constructed new houses between 1868 and 1870. Originally

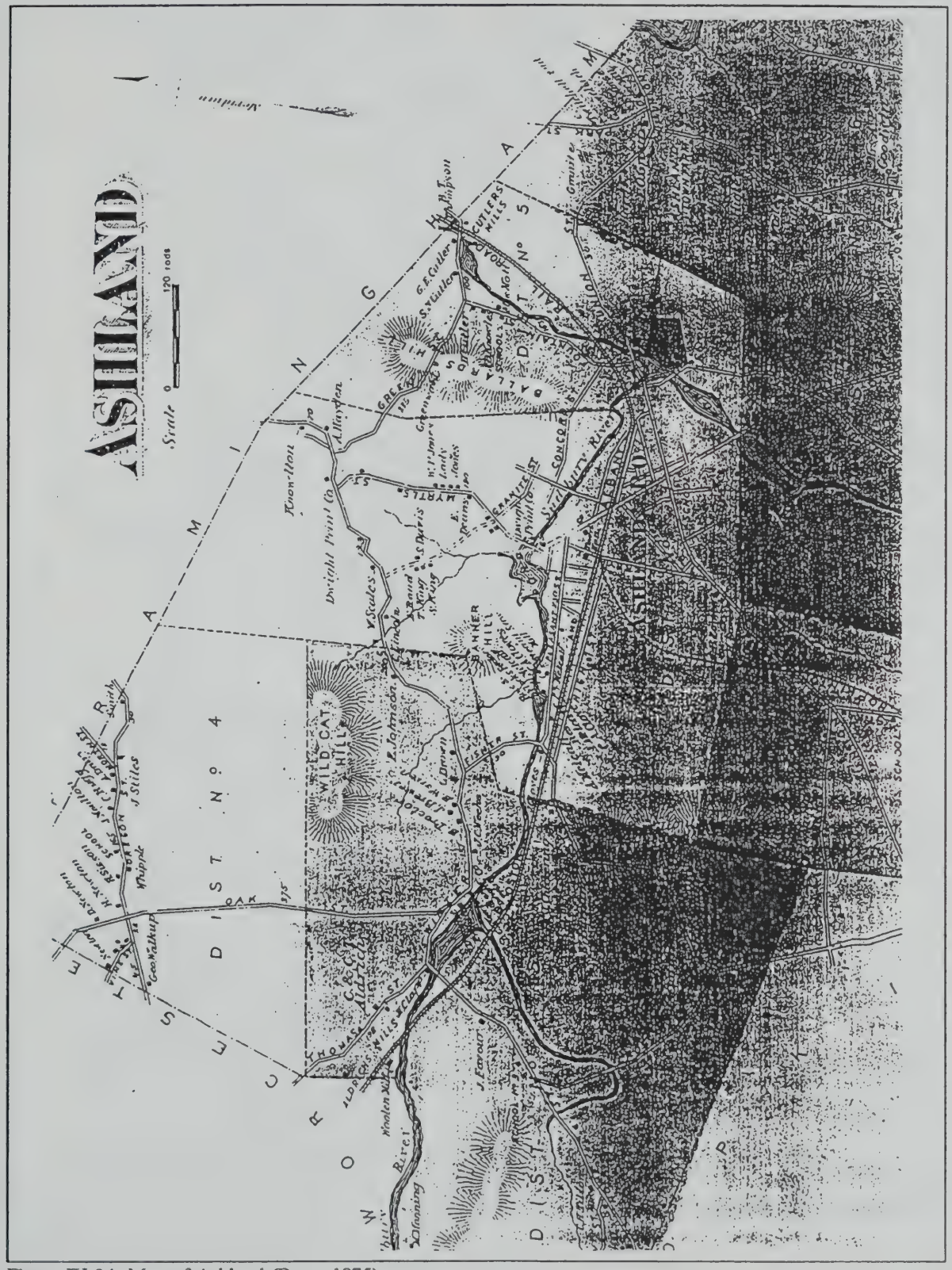


Figure IV-24 Map of Ashland (Beers 1875).

developed around the concept of printing directly onto cotton, the company's future was seriously jeopardized by the realization that chemical dyes would pollute the Sudbury River. A final blow to the company's future came with the damming of the Sudbury River for the Metropolitan Water Supply system, thereby condemning company lands and removing their power source (Works Progress Administration 1942:70).

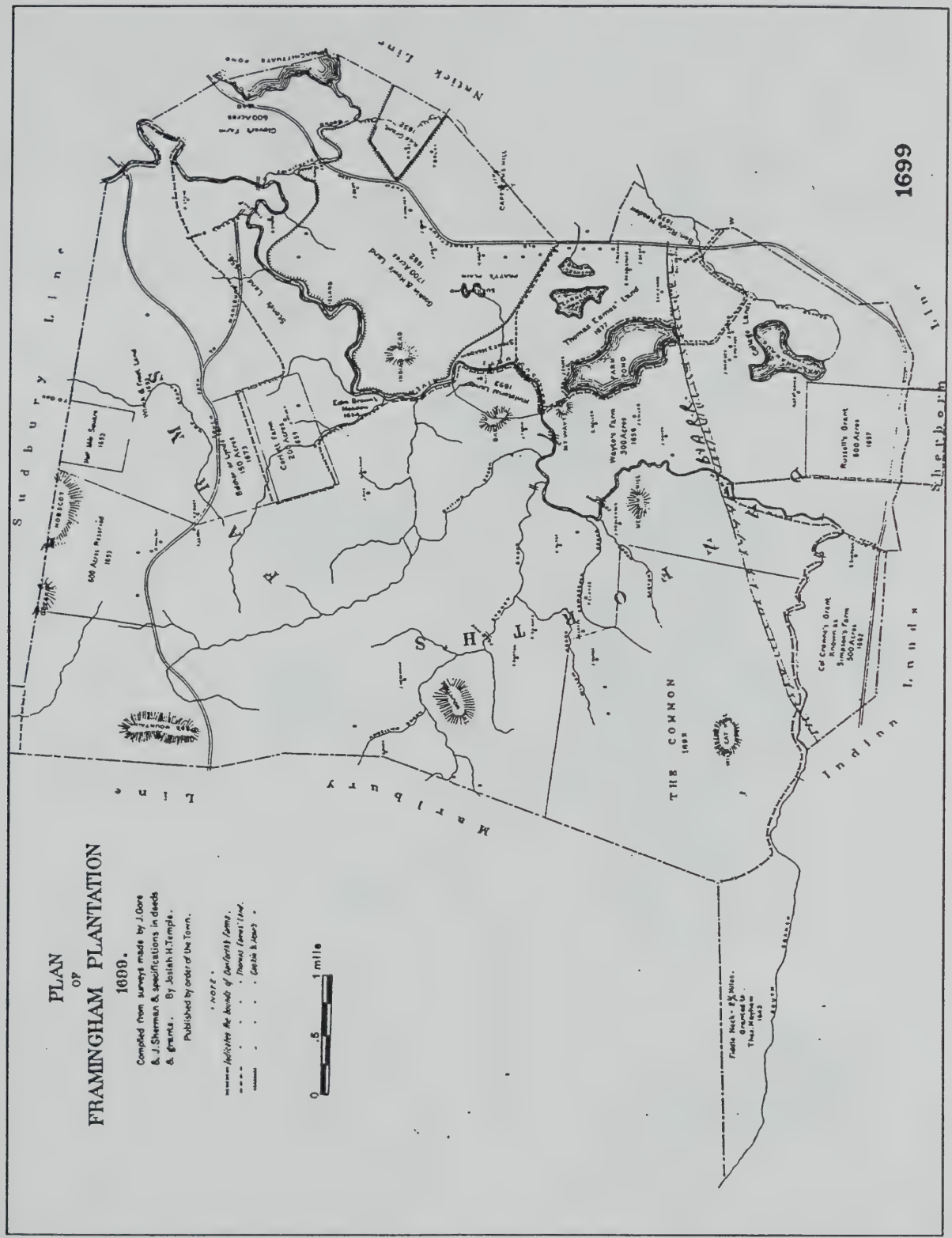
Some new building occurred in the late nineteenth century and included a granite railroad station (ca.1888) and utilitarian mills built in several locations along the railroad bed near the town center (Massachusetts Historical Commission 1980a:6). Significant among these is the ca. 1917 U.S. Color and Chemical Company, later the Chemical Manufacturing Company, located a quarter of a mile west of the former Ashland train station, paralleling the main tracks of the Boston and Albany Railroad (Works Progress Administration 1942:75). However, little additional construction or significant development has occurred in Ashland since the Second World War and the majority of industrial development dates to the later nineteenth century.

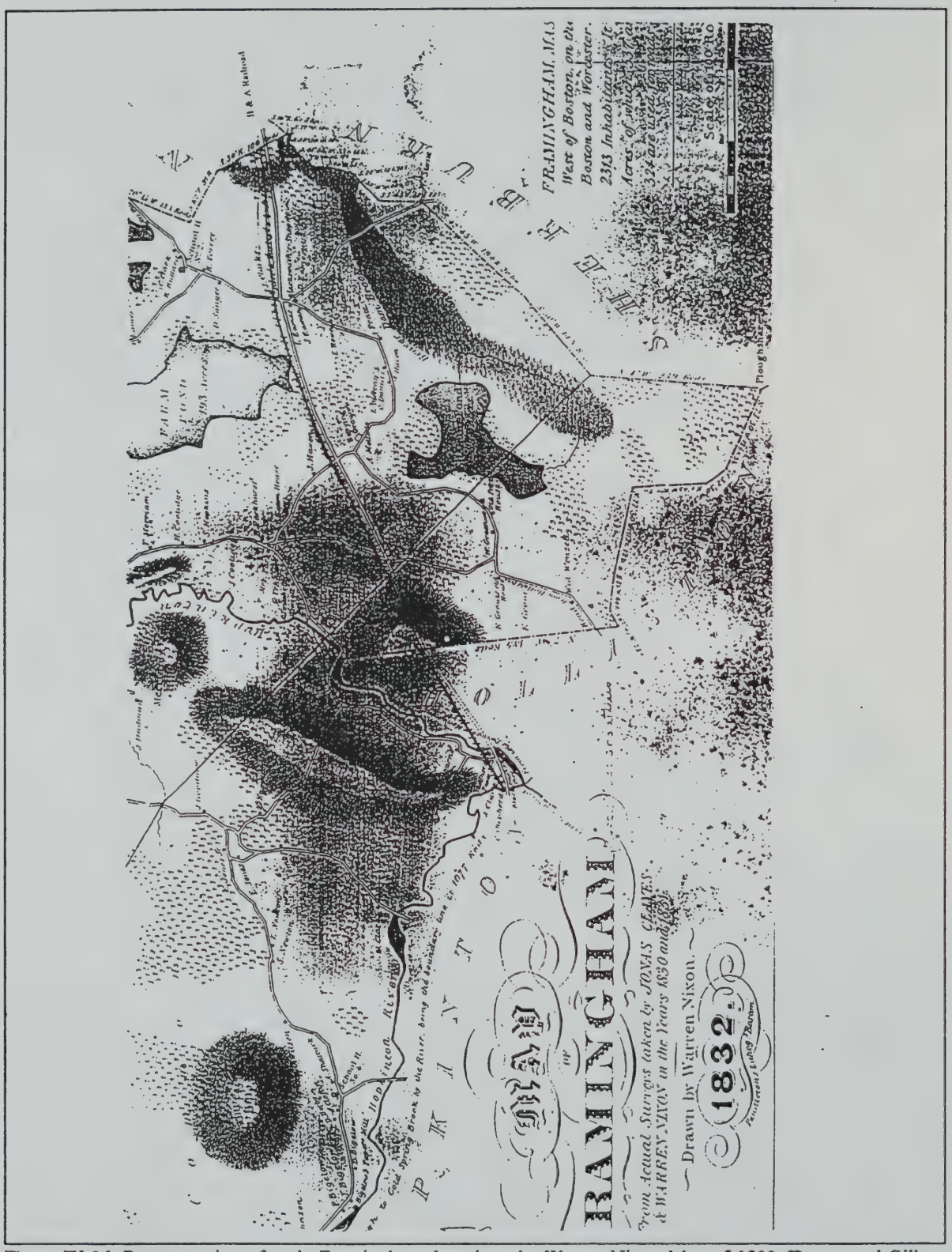
H. Framingham

Originally known as Danforth Farms, the first land grants in Framingham were made between 1640 and 1680 (Fig. IV-25). The earliest farms and settlements are located in the northeast section of the town, with subsequent development at Saxonville (the area of Elm and Water Streets) and at Pratt's Plain (the area near the intersection of Cochituate Road, and the Massachusetts Turnpike) (Fig.IV-26). Both areas of early development are some distance from the project's right-of-way (Massachusetts Historical Commission 1980b:2-3). The Nathaniel Eames farm, shown on Temple's reconstruction of the Framingham Plantation, 1699 (Fig. IV-25) appears just east of Farm Pond and may be near the WCRE rail corridor. (The available cartographic information does not permit a precise identification of its location).

The initial settlement of Framingham consisted of scattered farmsteads set along existing trails and at water sources, with no apparent village center (Massachusetts Historical Commission 1980b:1-2). The location of the town center itself became a compromise following the town's incorporation in 1700 (Massachusetts Historical Commission 1980b:1). By the nineteenth century, three separate areas of development were apparent. The early growth of the mill village of Saxonville continued with moderate residential and commercial development, and the town center retained some of its early institutional focus, while South Framingham rapidly developed following the railroad's construction in 1834 (Massachusetts Historical Commission 1980b:1).

After the completion of the railroad in 1835, South Framingham responded to the opportunities offered by rapid rail transportation, becoming the economic and industrial center of town; the former center remained a place of high-status residences (Dewar and Gilbert 1974:8-12, Massachusetts Historical Commission 1980b:1). The railroad stimulated the relocation of older buildings, such as the Town Hall, the High School, and the Centre Bank, from the former town center to South Framingham. The railroad also promoted the growth of the straw-hat industry, and the manufacture of boots and shoes. Finally, the railroad opened up new areas for development, like Harmony Grove near Farm Pond, where religious, social and political events (e.g. Anti-Slavery Society meetings) took place (Dewar and Gilbert 1974:11-12). South Framingham's growth is apparent from statistics, which reveal that the population almost doubled within a decade and a half (Massachusetts Historical Commission 1980b:7-9).


PLAN
OF
FRAMINGHAM PLANTATION
1699.
Compiled from surveys made by J. Gore & J. Sherman & specifications in deeds & grants. By Josiah H. Temple.
Published by order of the Town.
NOTE.
Indicates the bounds of Garfield's farms.
Thomas Carter's land.
Gates & Jones.
0
.5
1 mile
1699
Sudbury Line
Natick Line
Marlborough Line
Indian Land
Cherbon Line
THE COMMON
1699
Waylen's Farm
300 Acres
1699
Russell's Grant
800 Acres
1697
Col Cranney's Grant
Rogers &
Simpson's Farm
300 Acres
1697
Thomas Carter's Land
1697
Gates & Jones Land
1700 Acres
1692
Carter's Farm
200 Acres
1697
Farm Mill Stream
1693
Bacon's Farm
150 Acres
1697
Indian Fort
Cedar Swamp
Cedar Brook
Meadow
Indian Fort
Cedar Swamp
Bay Meadow
Wayland Line
Cedar Hill
Cedar Swamp
Cedar Hill
Cedar Swamp
Cedar Hill
Cedar Swamp


FRAMINGHAM, MASS
West of Boston, on the
Boston and Worcester.
2313 Inhabitants
Acres of
Scale of 10 to
FRAMINGHAM
From Actual Surveys taken by JONAS CLARKE
& WARREN NIXON in the Years 1830 and 1831
Drawn by Warren Nixon.
1832
Lithographed by Pendleton's Lith. Boston
Pleasant Brook by the River, being the boundary line in 1677
Mill River
Mill Pond
Saxonville
Mt Wayte
Mt Nebo
Mt Hemlock
Mt Cushing
Mt Singer
Mt Tom
Mt Pleasant
Mt Hope
Mt Wilson
Mt Grant
Mt Wright
Mt Hunter
Mt Leander
Mt Pisgah
Mt Ararat
Mt Ephraim
Mt Gilboa
Mt Moriah
Mt Zion
Mt Sinai
Mt Carmel
Mt Lebanon
Mt Olivet
Mt Calvary
Mt Tabor
Mt Horeb
Mt Sion
Mt Gerizim
Mt Ebal
Mt Nebo

The construction of the Sudbury Aqueduct (ca. 1874-1876) worked in tandem with the rise of the railroad to facilitate the growth of industry. A plentiful and reliable water supply supported steam-powered industry, and several brick factories were built along the railroad bed at South Framingham and Coburnville (Massachusetts Historical Commission 1980b:7). Industrial structures built at this time include the T.L. Barber straw works on Park Street, just north of the rail line at Farm Pond (Massachusetts Historical Commission 1980b:6). Rows of wooden tenement houses were located south of the railroad bed in South Framingham. To the west of the depot, on the railroad line around Winter Street, the village of Coburnville developed in the late nineteenth century. Here were located the Coburn Boot Co. and Gregory & Co. boot factory. Two rubber companies, Gossamer Rubber on Waverley Street, and the Para Rubber Shoe Co., (Dennison Manufacturing), were also located in close proximity to the railroad (Massachusetts Historical Commission 1980b:8).

A series of railroad-related structures also occurred in the vicinity of Farm Pond immediately north of the railroad lines, including a coal shed, a freight house, and an engine house (Fig. IV-27). Following the scheduled stop at the train depot, the locomotives halted at the pond to take in water passed up in pails (Temple 1891:376). At least two fires have damaged these types of railroad structures in Framingham. In 1863 a large railroad storage building caught on fire, and in 1865 the depot and a supply of railroad wood burned, along with several railroad buildings. According to contemporary sources the fire was so hot that "the sleepers burned and the rails curled up like hoop iron" (Dewar and Gilbert 1974:13). Perhaps to lessen the threat of wood supplies' catching fire and damaging wooden railroad structures, the Boston and Albany Railroad erected a series of stone depots in the late nineteenth century. At Framingham the new stone depot, designed by Henry Richardson, was constructed between 1886 and 1887 and is still standing (Dewar and Gilbert 1974:13).

Historic maps indicate the location of railroad-related sheds and storage structures at the junction of Concord Street and Route 135 (Figs. IV-27, IV-28, and IV-29). These include the Boston and Albany Railroad Hotel, in the northeastern quadrant of the present intersection. Two panoramic views of Framingham reveal additional structures and features (such as a train signal box) along both sides of the tracks by the end of the nineteenth century (Bailey 1882, 1898). These over-size views demonstrate the link between rapid transportation and industry, evident in the number and variety of buildings sited next to the railroad.

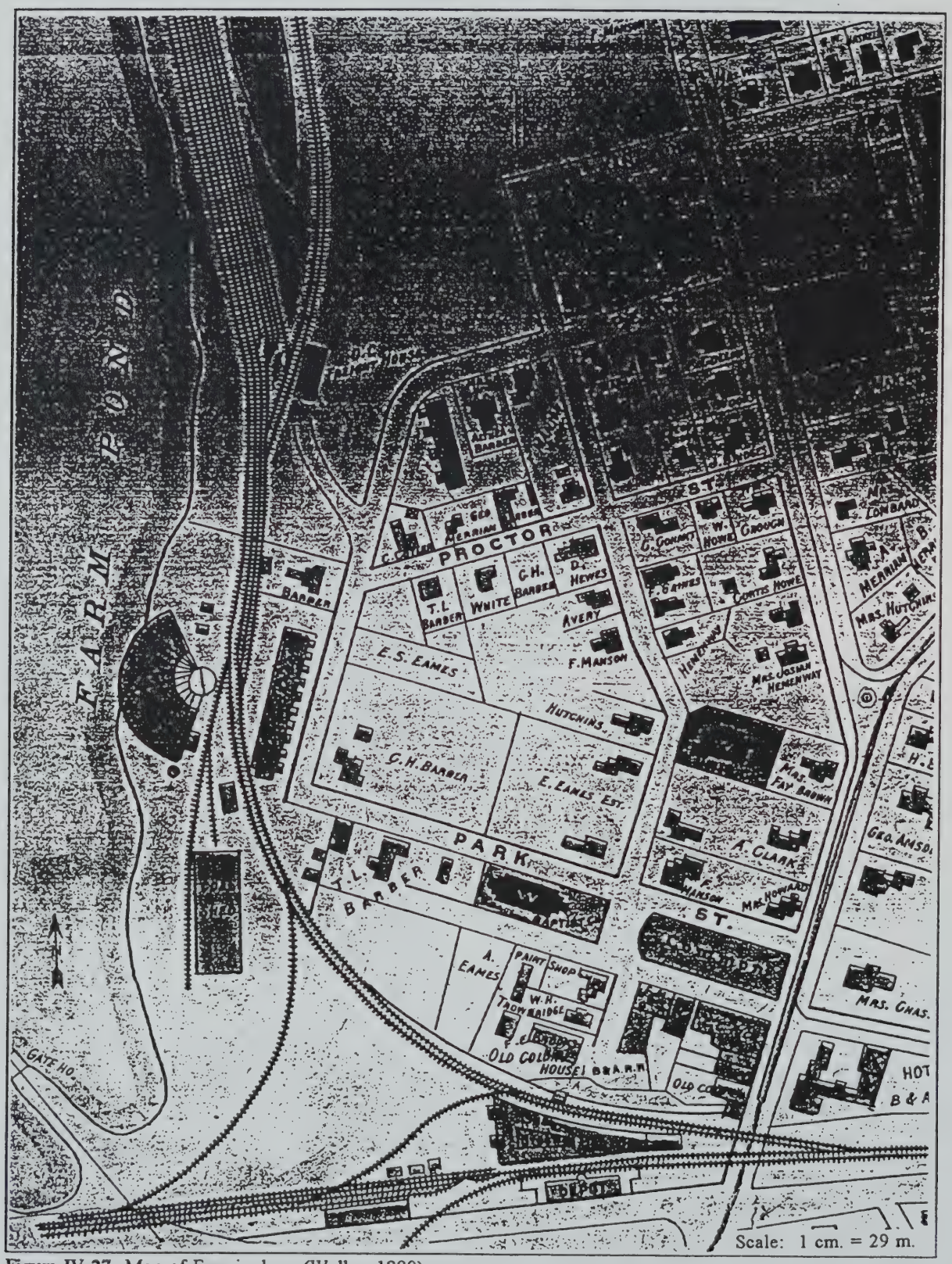


Figure IV-27 Map of Framingham (Walker 1889).

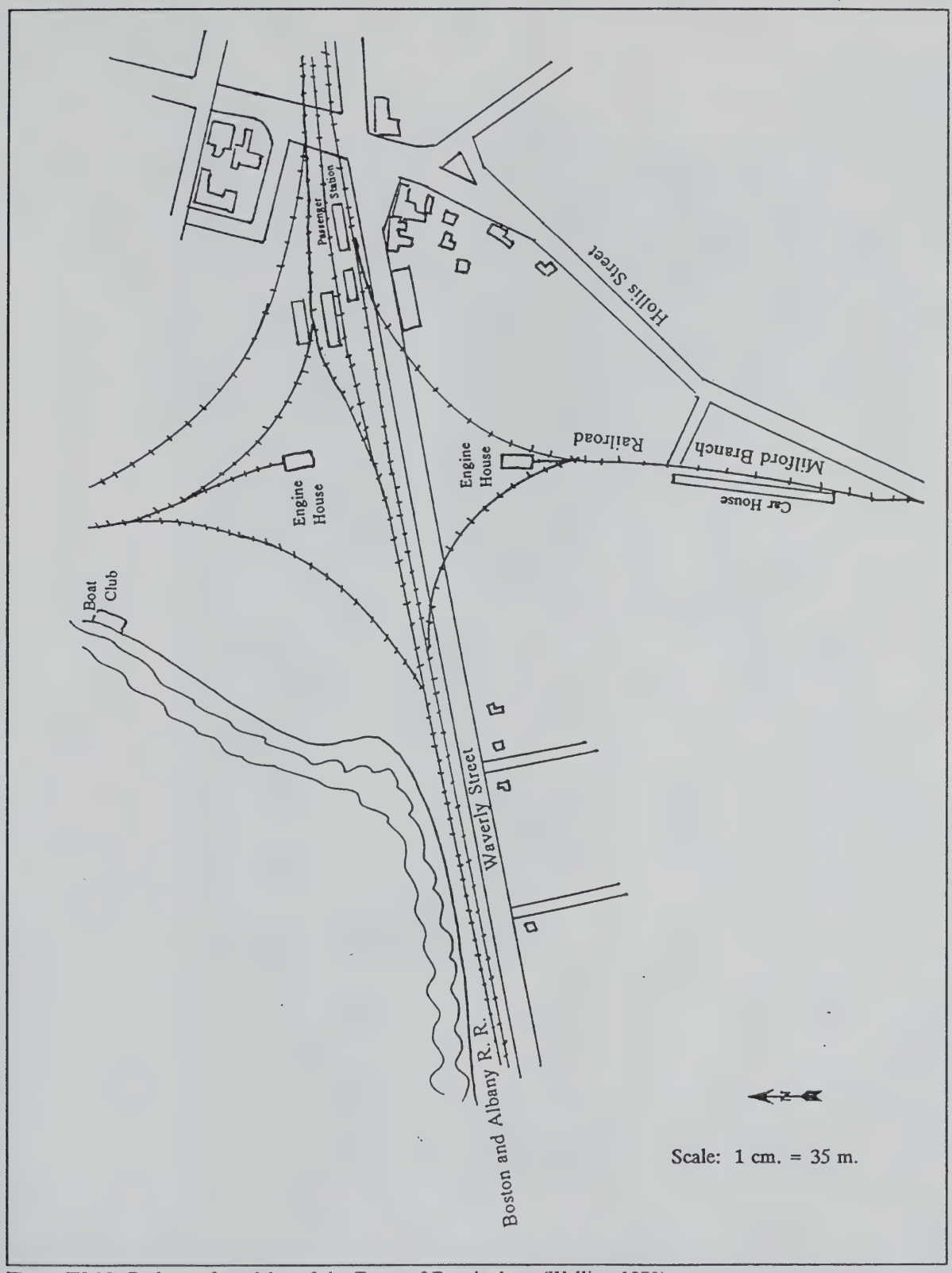


Figure IV-28 Redrawn from Map of the Town of Framingham (Walling 1872).

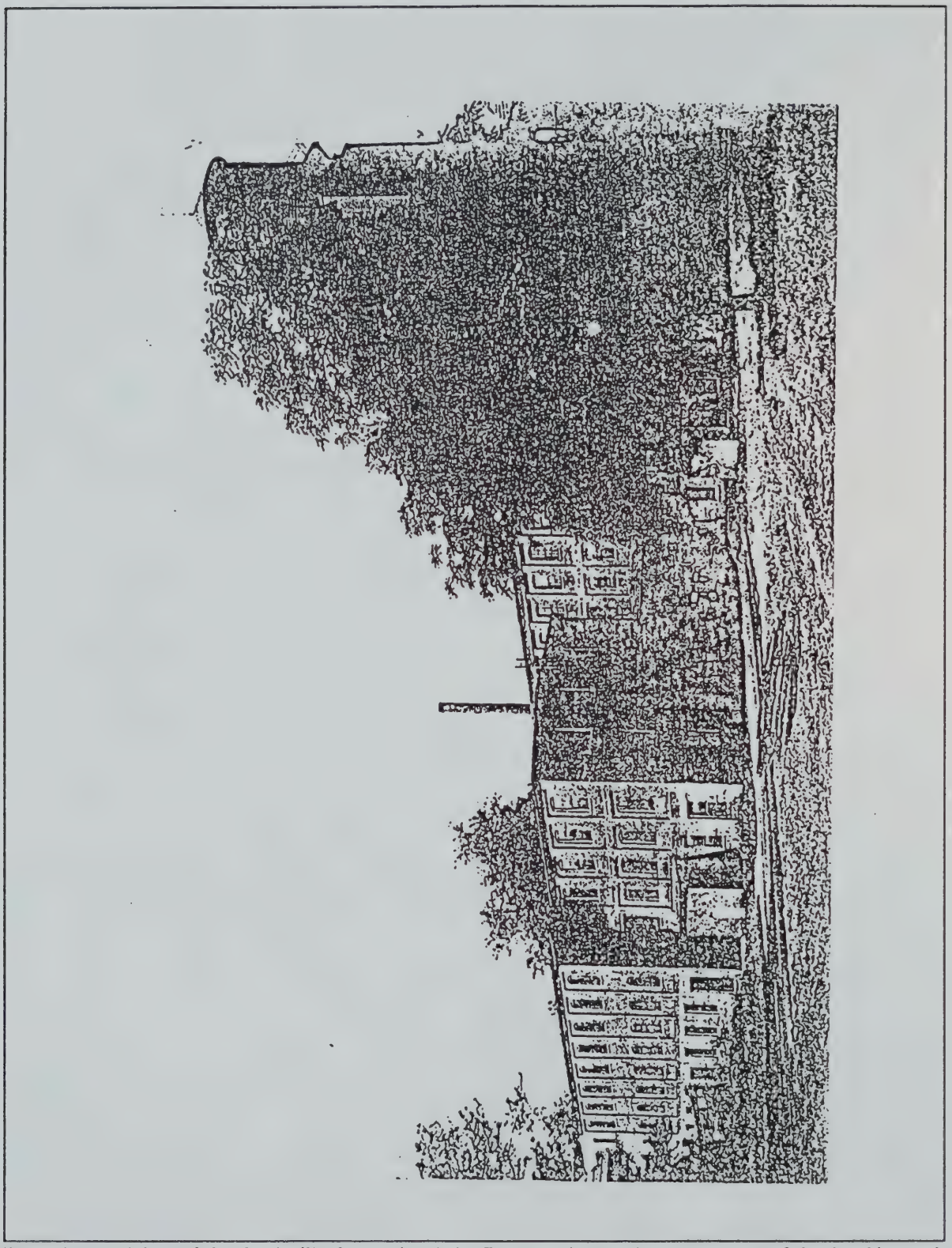


Figure IV-29 View of the Cordaville factory in 1928. From auction catalogue, courtesy of the Southborough Library.

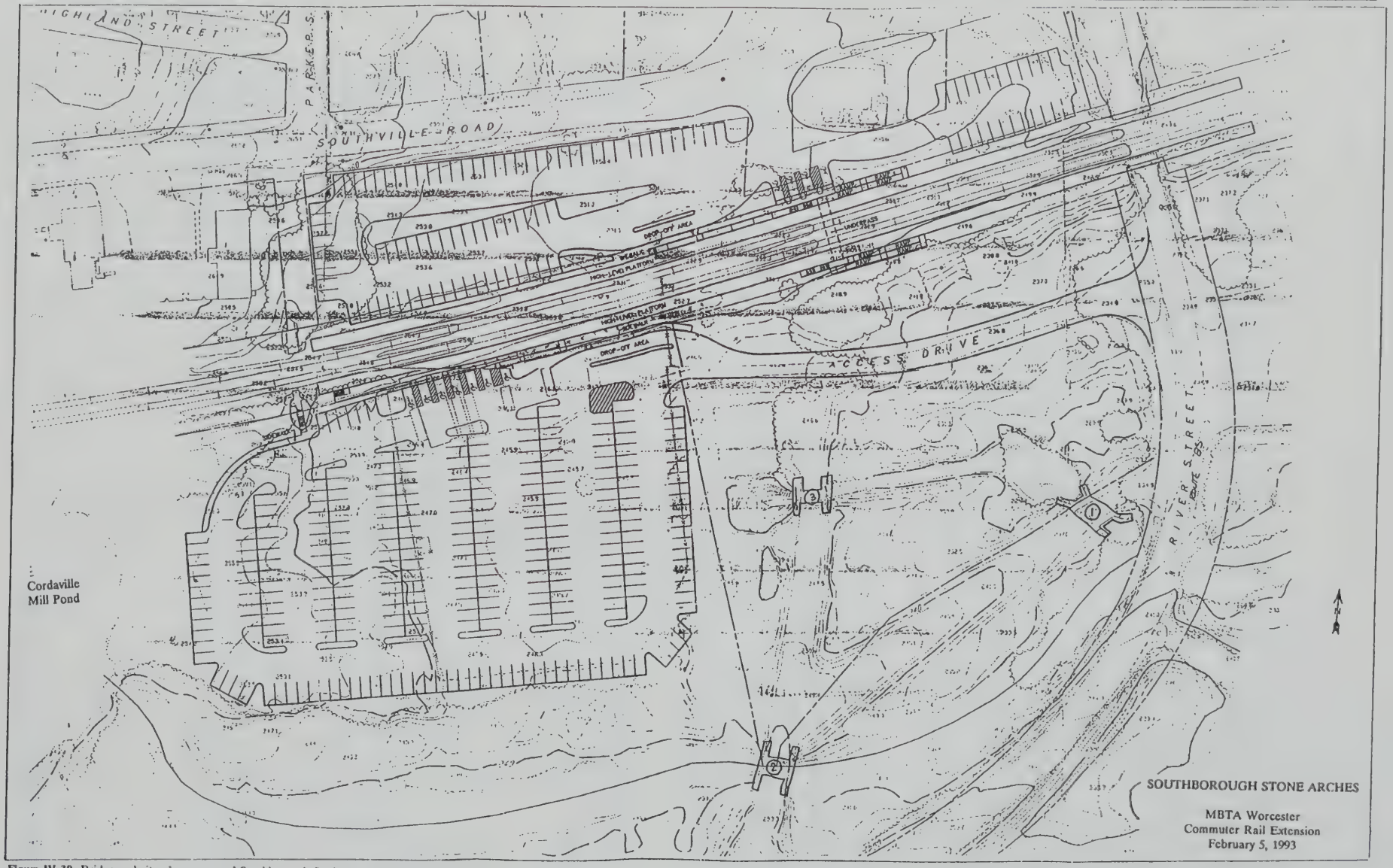


Figure IV-30 Bridge and site plan, proposed Southborough Station. (No scale available.)

V. RECONNAISSANCE SURVEY

A. Archaeological

To conduct the archaeological reconnaissance survey, two individuals walked the length of the existing rail corridor between Worcester and Framingham. The survey addressed the rail bed and the adjacent disturbance (drainage facilities, berms, stone walls, etc.) both along the rail corridor itself, and up to 50 m. away from the right-of-way. The locations of proposed stations and their access roads were given separate attention.

The principal intent of the walkover was the generation of information to be used in predictive modeling of prehistoric site location. The walkover noted the changing conditions along the rail corridor in terms of slope, neighboring surface water, and apparent disturbance, thereby defining segments of the corridor according to these changing conditions. The field information would then be combined with information from United States Geological Service quad sheets, Department of Agriculture soil maps, and historic maps to refine the definition of corridor segments, and to generate predictions of archaeological sensitivity. The modeling results are presented below, in Sections VI and VII.

The walkover survey also attempted to identify archaeological resources along the rail corridor, by inspecting areas of erosion, tree-throws, and other sources of soil exposure, and by searching for traces of architectural structures. The survey identified several archaeological sites, one prehistoric and three historic, along the project corridor in this manner.

The prehistoric site is eroding from the top of a cut through a knoll in Cedar Swamp (Westborough) in Segment 9i (for definition of survey segments, see Section VIII. A. below). This setting broadly corresponds to the location of a cluster of previously recorded prehistoric sites (19-WR-417 to -420) within the Cedar Swamp Archaeological District, which is listed in the National Register of Historic Places. The collected artifacts included two felsite flakes, two quartz flakes, and four pieces of quartz shatter, scattered along 30 m. of the crest at the top of the cut. Erosion of the bank is slowly destroying the site; any additional disturbance at the toe of the slope will accelerate the loss of the site to erosion.

The walkover also identified three historic sites.

1. A mill in Westborough, near the Westborough-Southborough town line, adjacent to the Sudbury River and Fruit Street, in Segment 10a. A grist mill and a sawmill existed in this location by 1837. The observed structures included two long walls, one linear (about 27 m. long), running between the rail bed and the Sudbury River, the other curved (about 67 m. long) along the bank of the river and meeting the linear wall at a probable mill seat on the river. Stone wall continues on the far side of the river, but was not inspected. Other structures in this complex included an arched stone culvert or sluice between the two walls, and a rectangular stone foundation downstream from the linear wall. The rail bed lies about 15 m. away from the observable sections of the major wall. Since mills existed in this location by the 1830s, the railroad track may encroach on subsurface components of the site.

2. A mill in Southborough, on the Southborough-Ashland town line, in the location of the Aldrich woolen mill of the 1870s, in Segment 11g. The observed structures included a 60 m.-long granite dam between

the rail bed and the Sudbury River (the dam continued on the south side of the river, but was not inspected), with a complex sluice system and mill seat immediately adjacent to the rail bed. The Aldrich mill extends to the edge of the existing railroad bed, and may be impacted by project construction.

3. A probable farmstead lies south of the rail bed in Southborough, on a low rise that overlooks the Sudbury River farther south, in Segment 10b. The visible architecture includes:

- A small (2 x 3 m.) stone-lined depression that is a probable cellar hole;
- an oval chamber (roughly 10 x 6 m.), the stone walls of which survive to several meters in height and are supplied with a south-facing entrance way, perhaps identifiable as a silo;
- a stone-lined well immediately outside the silo entrance; and
- several stone field walls.

An abandoned woods road lies south of this complex; a 9 x 5 m. rectangular foundation sits just off this road, to the east of the previously described complex. These architectural remains all occur at least 20 m. south of the rail bed, and are unlikely to be impacted by the WCRE project.

As part of the reconnaissance survey, Joyce Clements also monitored the test pits being dug for toxic waste assessment in the proposed locations of the Southborough, Westborough, and Grafton stations. These machine-dug pits extended 6-13 ft. below the ground surface, affording an opportunity to examine the subsurface condition of the station areas, and to form expectations about the potential cultural resources in these areas.

B. Architectural

The architectural "windshield survey" was undertaken in February and March, 1993; additional survey was undertaken in July, 1993, when alternative station locations were selected for study. The windshield survey was done to determine the number of structures fifty years old and older that were located within the study area. Approximately 200 properties were identified as requiring inventory forms. It is estimated that during actual field work approximately 10 more structures may be identified as requiring inventory forms.

Initial property types identified include the following:

- Residential structures, consisting mostly of wood-frame, single-family dwellings;
- industrial structures, consisting mostly of masonry factories located near rail service;
- railroad-related structures, including former Boston and Albany stations designed by H.H. Richardson and built in the late 1880s; and
- bridges, including highway and railroad bridges.

Other structures, which do not fall within the types identified above, include Grafton State Hospital in Grafton and Lloyd's Diner in Ashland.

In addition to the windshield survey, inventory forms and National Register forms for properties within the project area were reviewed at the Massachusetts Historical Commission. Research repositories and sources were

identified for the inventory phase. Finally, each property to be inventoried was assigned a number and plotted on a map.

An architectural survey will be performed to determine whether there will be impacts to structures fifty years old and older. The Massachusetts Historical Commission has identified the following properties listed on the state and national registers of Historic Places as being in or near the project area:

- Concord Square Historic District, Framingham;
- Framingham Railroad Station, Framingham;
- Sudbury Aqueduct, Framingham;
- Grafton State Hospital, Grafton;
- multiple properties in Worcester, including Union Station.

In addition, there are properties along the project route that have been identified in inventory surveys and "historically and architecturally significant properties in the project area that have not yet been formally identified, inventoried, and evaluated for National Register eligibility," according to the Massachusetts Historical Commission in a letter dated July 24, 1992.

The architectural survey will be based upon a corridor of 100 ft., i.e. 50 ft. in each direction on both sides of the center line of the existing tracks. This is between 20 and 60 ft. wider than the existing corridor. This area is extended to properties surrounding proposed station locations. For the most part, these boundaries result in a survey area "one property deep."

Many of the structures that will be surveyed for this project were built after the original Boston and Worcester Railroad tracks were laid from Boston to Worcester (1835). Commuter rail was discontinued on this line in 1975, but freight trains and Amtrak trains use this line, and the road has had continuous traffic since its inception in 1835. Although all structures will be evaluated for visual and construction impacts, it is not anticipated that these will be significant because the majority of structures appear to have been built after the rail line was constructed. Therefore, properties along the rail corridor, outside of station sites, can be expected not to experience any visual or construction impacts since the changes to an already-active rail line will be minimal.

VI. MODELING PREHISTORIC SITE LOCATION

A. Theoretical Framework

Settlement models seek to examine the disposition of human communities across a given landscape, i.e. to analyze cultural rather than natural landscapes. In archaeological examples of this endeavor, three factors -- settlement location, function,and seasonality -- are central, and these together define the ways in which aboriginal communities adapted to, and took advantage of, the resources offered by a given natural landscape. Models of prehistoric cultural landscapes may be grounded in one of two methods, deductive or inductive.

The deductive model predicts where sites should be if prehistoric communities sought to optimize foraging efforts in a given landscape, an application of optimal foraging theory to human populations. The deductive method requires extensive knowledge of the dynamic terminal Pleistocene and Holocene environments of southern New England,and detailed geomorphological study of the local landscape. For the most part, these empirical requirements are not satisfied for southern New England; furthermore, the method encounters serious theoretical objections to its basic assumptions of human action. At the same time, the deductive method does help to explain the patterns discovered by the inductive method. Ideally, settlement-pattern analysis proceeds by an interplay of the two methods. In southern New England, deductive models help to account for major settlement shifts in the rapidly changing post-glacial context (for example, the glacial-lake-basin mosaic model, Nicholas 1988; see also Curran and Dincauze 1977), the relationship between site location and exploitation of anadromous fish runs (e.g. Moore and Root 1979), and the mix of littoral, estuarine, and continental foods in specific contexts (e.g. Perlman 1976).

The inductive method tabulates known site information according to a series of variables thought to be determinate, such as slope of terrain, or distance from water; the method statistically or intuitively describes the emergent patterns. This method has a relatively long history in archaeological work in New England, and underlies most of the settlement models found in the professional literature (e.g. Dincauze and Meyer 1977, Kenyon and McDowell 1983).

In southern New England archaeology, prehistoric site location is typically expressed according to three variables -- terrain, soils, and water -- in the formula "flat to low slope, well-drained sandy soil, near water." Subsidiary factors may also figure in this general formula. For example, sites tend to be along aboriginal trails, near outcrops of knappable stone, on south-facing exposures. The general formula is the product both of intuition and of statistical evaluation. In rudimentary form, the formula is more than a century old, as expressed in Hodgman's observation that near Westford the "favorite haunts of the Indians ... were generally-near a stream or spring [and also ponds], but sometimes on a warm hillside" (Hodgman 1883:3). More recent efforts have statistically confirmed these intuitive generalities at the regional scale.

Dincauze and Meyer (1977) report that 47% of tabulated sites in Essex County, and 76% of tabulated sites in Middlesex County, occur on land with less than 8% slope and with well-to-excessively drained soils; another 10-20% of tabulated sites lie on well-drained soils at 8-15% slope in the two counties. Barber's compilation, looking at all of southern New England, indicates similar conclusions. Barber also observed a differential relationship between sites and types of water, namely that sites are most strongly associated with small rivers and streams, and less strongly with lakes, large rivers, and wetlands (Barber 1979:230).

Kenyon and McDowell (1983) examined the Merrimack River drainage in a more detailed fashion, again with comparable results. The Kenyon-McDowell study reached several important conclusions. Roughly 30% of sites were situated on alluvial deposits, 40% on river terraces, 20% on fluvioglacial deltas, outwash and lake beds, and less than 10% on glacial till. These settings corresponded both to land forms and to the character of their soils. The Merrimack River and its major tributaries provided the single most important determinant of site location, with nearly two thirds of the sites occurring within 200 m. of the river. Moreover, two thirds of the sites were also located close to wetlands, brooks, or both, but relatively few sites occurred near ponds unless also near these other hydrological features. Only 15% of the recorded sites were not located with respect to these minor hydrological features.

These inductive models are designed primarily to correlate land forms with site presence/absence as a statistical summary of a cultural landscape. The models in this sense are locational, but are not statistically predictive. If, for example, 80% of the prehistoric sites in a district fall on well-drained level ground within 100 m. of water, this strong association does not confer an 80% probability of finding sites on a given parcel that displays these topographic characteristics within the district.

Furthermore, the models are not necessarily sensitive to site function and seasonality, and so do not deal adequately with site sizes and densities. For example, the model indicates in a qualitative way the regularity with which prehistoric sites occur near small streams and wetlands. In terms of modeling prehistoric land use, these locations represent special activities, seasonal resources, or minor components of adjustments to resource opportunities within an interior upland region in the headwaters of a major river drainage. But the model does not predict the specific nature or seasonality of activities. Seasonality information for sites in other upland districts of eastern Massachusetts implies episodic activities throughout the year (contrast the conclusions of Huntington 1982 for the Flagg Swamp rock shelter in Marlborough, Mahlstedt 1985 for the Reedy Meadow Brook site in Pepperell, and Ritchie 1985 for the Hartford Avenue rock shelter in Uxbridge).

The model also does not explain the observed settlement patterns with reference to the constituent environmental factors. For example, soil characteristics establish the edaphic conditions that limit the composition of the botanical communities, and thus indirectly also the associated faunal communities, from which foragers gain their livelihoods. However, the gross soil categories alone do not determine the specific composition of these communities, which also respond to climatic conditions and to human manipulation (especially controlled fires; see Cronon 1983, Patterson and Sassaman 1988). The descriptive factors of the settlement model simply stand as glosses of, and proxies for, the ecological complexities of a dynamic cultural landscape, but do not reveal those complexities. These locational models provide good second-order descriptive summaries of cultural landscapes, but remain outside the dynamics of these landscapes.

B. Modeling Dimensions

As the previous section indicates, the three critical dimensions for modeling archaeological sensitivity are slope, distance from water, and soil drainage. The combination of these three dimensions permits an assessment of the likelihood that prehistoric sites occur at a given point in the rail corridor, all other things being equal. The latter qualification to the sensitivity assessment refers mainly to the disturbance created by European-American development and land modifications over the past 350 years.

1. *Distance from Water*

The results of several site-location studies in southern New England indicate that proximity to water forms a major determinant of site presence. In general, the density of prehistoric sites decreases geometrically with distance from water. The type of water also strongly influences the nature of the prehistoric site. Many large and multicomponent sites are set along major rivers and streams, most frequently at barriers such as falls, rapids, and shallows where anadromous fish were most readily available. Many small and diffuse, usually single-occupation sites are located around the margins of wetlands and on higher land within wetlands, to take advantage of the seasonal resources available in these settings. And major, multicomponent settlements occur at the edges of ponds and lakes, especially on higher ground overlooking lakes connected to a regional drainage.

The ranking of sections within the rail corridor is based on distance from existing surface water, according to the following parameters:

I.	High potential	<100 m. from water
II.	Moderate potential	100-200 m. from water
III.	Low potential	>200 m. from water

This ranking procedure makes two critical assumptions.

The first assumption is that all kinds of surface water (e.g. rivers, brooks, lakes, swamps) were equally attractive to prehistoric communities, and therefore equally predict site location. This assumption cannot be true in any meaningful way. Different kinds of water support different kinds of natural resources, and must be differentially fitted into regional adaptive strategies. Moreover, the natural distribution of water (i.e. that prior to human interference) is a product of the geomorphological forces at work on the post-glacial landscape over the past 14,000 years. The most pertinent of these forces is the gradual alteration of ponds and lakes, in the normal succession oligotrophic (low in plant nutrients) to eutrophic conditions (high in plant nutrients), then gradual in-filling and eventual establishment of dry-land forest communities. This succession implies alteration to the productivity of ponds and wetlands, and therefore changing attractiveness for prehistoric use and site location. Even so, the assumption can be used broadly to distinguish between sections of the rail corridor with potentially high-productivity wetlands from those sections without this potential.

The second assumption asserts that surface water existing today also existed in the past. This assumption is likewise not valid. In addition to the geomorphological alterations mentioned in the previous paragraph, cultural manipulation has significantly changed the landscape over the past several centuries. Since flowing water provided power to mills, industrialization involved alteration of the natural distribution of surface water across the Massachusetts landscape. The rail corridor passes along or near several major bodies of open water or wetlands that resulted from this process. Several obvious examples include the creation of Hovey Pond and connected bodies of water (Grafton) by damming for a mill in the nineteenth century, the creation of extensive open water and wetlands in the headwaters of the Assabet River by the George H Nichols Dam (Westborough) in the twentieth century, and ponding of water along the Sudbury River for mills beginning in the nineteenth century (Southborough to Framingham). In typical cases, the new bodies of surface water were created by damming existing streams in low-lying areas that already enclosed some wetlands.

2. *Slope*

According to various empirical studies, prehistoric sites normally occur on terrain with less than 15% slope, and most frequently appear on terrain less than 8% slopes. This pattern is most reasonably explained by the greater ease of living and working on more level surfaces. The ranking of sections within the rail corridor is based on these empirical generalizations, to form the following categories:

I.	High potential	<8% slope
II.	Moderate potential	8-15% slope
III.	Low potential	>15% slope

3. *Soil Characteristics*

Certain characteristics of soils potentially provide a very sensitive predictor of site location. At the regional level, prehistoric sites are strongly associated with well drained and sandy soils, in preference to less-well-drained soils, shallow soils with extensively outcropping bedrock, or soils with a high gravel content. However, areas of poorly-drained or stony soils may include pockets of well-drained, sandy soils that attract prehistoric occupation. For example, the Black Bear site (19-WR-308) in Sutton sits in exactly such a sand pocket within moraine gravels, a commonly observed pattern in southern New England (Thorbahn and Cox 1983: 81, 83).

The reasons for the strong association between prehistoric sites on the one hand, and the drainage and particle size characteristics of soils on the other are not clear. The association may simply reflect a preference for living on drier and finer soils; the association may also involve the more complex relationships between edaphic conditions, plant and animal communities, and prehistoric foraging practices.

Whatever the causal relationships implicit in the soil characteristics, the empirical correlation of drainage and particle size with site location allows their use in modeling. The classification of the Soil Conservation Service (SCS) details many relevant soil characteristics, of which the predictive model uses only the drainage qualities and stoniness. The model uses three categories of drainage qualities: well to excessively drained, moderately well drained, and poorly to very poorly drained. And the model uses two categories of soil stoniness, separating sandy soil both from sandy soils with high to very high rock (gravel and/or cobbles) content and from thin soils with extensively outcropping bedrock. The stoniness attributes are applied only to soils that belong to one of the first two drainage categories, a procedure that works to reduce the predictive site potential of the well-to-excessively-drained soils. The resulting predictive ranking follows these combinations of criteria:

I.	High potential	well to excessively drained, sandy soils
II.	Moderate potential	moderately well drained, and/or rocky soils
III.	Low potential	poorly drained, and/or urban soils or udorthents (see section c. below for definition).

The SCS has mapped 24 distinct soils within the rail corridor, as well as urban soils and udorthents. The minimum mappable area of individual soils is approximately 2 ha. (5 acres), and pockets of different soils may exist within a given mapped soil. Moreover, considerable variation in texture may occur with the mapped area of individual soils, especially in soils that formed over glacial till and on glacial outwash plains. Thus the CSC

maps may serve only as very rough and broad-brush characterizations of soils within the rail corridor. These circumstances leave the predictive model operating at a fairly coarse resolution.

The following lists define the predictive ranking for the soils within the rail corridor. In addition to drainage and stoniness characteristics, these lists also mention the potential general utility of each soil.

a. High-Potential Soils

Agawam fine sandy loam (Ag)

Very deep, well drained, typically forms in long, narrow areas; rated good for forest communities, very poor for wetland communities, and good for farming.

Haven fine sandy loam

Very deep, well drained, typically forms on glacial outwash plains and terraces; rated good for forest communities, very poor for wetland communities, and very good for farming.

Hinckley sandy loam (Hg)

Very deep, excessively drained, forms in broad areas on outwash plains; rated poor for forest communities, very poor for wetland communities, and poor for farming.

Merrimac fine sandy loam (Me)

Very deep, somewhat excessively drained, forms in broad areas on outwash plains; rated fair habitat for forest communities, very poor for wetland communities, and fair for farming.

Paxton fine sandy loam (Pa)

Very deep, well drained, on drumlins and drumlin-like areas; rated good for forest communities, very poor for wetland communities, and fair for farming.

Windsor loamy fine sand (Wn)

Very deep, excessively drained, generally on rolling hills; rated poor for forest communities, very poor for wetland communities, and poor for farming.

b. Moderate-Potential Soils

Canton fine sandy loam, extremely stony (Cc)

Very deep, well drained, but contains significant amounts of gravel and rocks; forms on lower slopes of hills; rated good for forest communities, very poor for wetland communities, and very poor for farming.

Charlton fine sandy loam, extremely stony

Deep, well drained, but contains significant amounts of gravel and rocks; forms on upland ground moraine; rated good for forest communities, very poor for wetland communities, and very poor for farming.

Chatfield-Hollis rock outcrop complex (Ch)

Well drained to excessively drained, but shallow bedrock and significant surface stones; forms on hills and ridges; rated poor for forest communities, very poor for wetland communities, and very poor for farming.

Narragansett silt loam, very stony

Deep, well drained, but contains significant amounts of gravel; forms on till plains and ground moraine; rated good for forest communities, very poor for wetland communities, and very poor for farming.

Ninigret fine sandy loam (Ng)

Very deep, moderately well drained, forms on outwash plains; rated good for forest communities, poor for wetland communities, and good for farming.

Paxton fine sandy loam, extremely stony (Pc)

Very deep and well drained, but contains significant amounts of gravel and rocks; forms on drumlins and drumlin-like terrain; rated good for forest plant communities, poor to fair for forest wildlife, poor for wetland communities, and very poor for farming.

Pootatuck fine sandy loam

Deep, moderately well drained; forms on floodplain alluvium; rated good for forest communities, poor for wetland communities, and good for farming.

Rainbow silt loam

Deep, moderately well drained; forms on drumlins and ground moraine in eolian silts; rated good for forest communities, very poor for wetland communities, and good for farming.

Rainbow silt loam, very stony

Deep, moderately well drained; forms on drumlins and ground moraine in eolian silts; rated good for forest communities, very poor for wetland communities, and very poor for farming.

Scio silty loam

Very deep, moderately well drained, typically forms on glacial outwash, lacustrine, and aeolian deposits, rated fair for forest communites, poor for wetland communities, and good for farming.

Sudbury fine sandy loam (Sd)

Very deep, moderately well drained; forms on depressions in outwash plains; rated good for forest communities, poor for wetland communities, and fair for farming.

Woodbridge fine sandy loam, very stony (Ws)

Very deep, moderately well drained; forms on drumlin tops and on toe slopes of till uplands; rated good for forest communities, and very poor for farming.

Woodbridge fine sandy loam, extremely stony (Wt)

Very deep, moderately well drained; forms on drumlin tops and on toe slopes of till uplands; rated good to fair for forest communities, poor to very poor for wetland communities, and very poor for farming.

c. Low-Potential Soils

Freetown muck (Fm)

Very deep, very poorly drained; forms in depressions and drained glacial lake beds; rated poor for forest communities, good for wetland communities, and very poor for farming.

Freetown muck, ponded (Fp)

Very deep, covered with up to 2 ft. of water; forms in depressions and drained glacial lake beds; rated very poor for forest communities, good for wetland communities, and very poor for farming.

Ridgebury fine sandy loam, extremely stony (Rs)

Very deep, poorly drained; forms in depressions; rated fair for forest communities, fair for wetland communities, and very poor for farming.

Saco silt loam (Sa)

Very deep, very poorly drained; forms on flood plains; rated poor for forest communities, good for wetland communities, and very poor for farming.

Swansea muck (Sw)

Very deep, very poorly drained; forms in bogs and in depressions within outwash plains and upland till; rated poor for forest communities, good for wetland communities, and very poor for farming.

Walpole fine sandy loam (Wa)

Very deep, poorly drained; forms in outwash-plain depressions; rated fair for forest communities, good for wetland communities, and poor for farming.

Whitman loam (Wg)

Very deep, very poorly drained; forms in upland depressions; rated poor for forest communities, fair for wetland communities, and very poor for farming.

Urban Land (Ur)

The SCS rates as urban soils the densely developed areas of town and cities; in this usage, urban soils also denote areas of extensive disturbance (see below). In addition; the SCS classification contains mixed designations such as Urban Land-Hinckley and Paxton-Urban Land, in which the urban soils cover 25-50% of the mapped unit, with natural soils the remaining area. In these cases, the natural soil category is used to rank the appropriate segment of the rail corridor, with the assumption that the disturbance characterization of the same segment will reflect the urban component of the mixed soils.

Udorthents (Ud):

Whatever their characteristic drainage qualities and particle size, udorthents are excavated and/or redeposited soils, usually 2-20 ft. deep, and sometimes containing trash. As with the urban lands, this soil group also denotes extensive disturbance.

3. *Disturbance*

The ranking of sections within the rail corridor uses these different degrees of disturbance to form the following categories:

I.	High potential	no apparent disturbance
II.	Moderate potential	intermittent to moderate disturbance
III.	Low potential	extensive to total disturbance

Two distinct sorts of disturbance are apparent along the rail corridor: those of the rail line itself, and those of other (both pre- and post-rail) construction.

The existing rail line has three basic configurations.

1. When the line runs across flat terrain, the ballast is set in a shallow cut, equipped with drainage ditches along one or both sides. In this case, the width of disturbance is generally about 20-30 m. This disturbance destroyed most if not all of the sites within the rail corridor, but left intact all or portions of sites along each site of the rail line.

2. When the tracks cross high terrain, the ballast is laid in a deeper cut, the width of which is a function both of the depth of the cut and of the geomorphology of the terrain (e.g. bedrock versus drumlin). In these cases, the cut destroyed sites within the rail corridor, but may have left preserved portions of these sites at the edge of the cut. The prehistoric site observed during the reconnaissance walkover in Cedar Swamp provides an example of this situation.

3. When crossing low terrain, the tracks run along a higher ballast bed, the basal width of which is proportionate to its height. In these sections of the rail corridor, construction of the rail line may have buried existing sites under several meters of gravel ballast, perhaps preserving them in place.

These railroad disturbances suggest that the entire rail line has suffered negative impacts to some degree. However, the predictive model addresses the conditions along the edges of the WCRE project corridor, and the first patterns of disturbance will be ignored. The third pattern is given a rating of moderate disturbance, since any portion of sites left at the top of cuts may be threatened by construction impacts and by accelerated erosion even if the cut is not widened.

The second source of disturbance along the WCRE project corridor reflects the more regional forces of historical development. The European colonization of the region eventually produced alterations to the landscape that extensively altered the natural conditions of distance from water, slope, and soils. In many places, the landscape alterations have completely or largely destroyed the prehistoric sites that once existed. This degree of disturbance is most obvious in the town centers through which the rail corridor passes (Framingham, Ashland, Westborough, Worcester). The same degree of disturbance is present along the industrial corridors that developed along the railroad during the nineteenth and twentieth centuries (all towns but Millbury and Grafton to some degree). In many cases, these zones are marked by urban soils or udorthents (see previous section). These cases are ranked as extensive to total disturbances, and rated low in probability of containing prehistoric

In other places, disturbance has impacted but not destroyed resources, resulting in partially intact sites. A common impact is agricultural plowing, which redistributes artifacts and destroys the upper sections of features in sites. Another common impact is construction that completely destroys part of a site, but leaves the remainder undisturbed. The resulting disturbance may be intermittent within a larger zone of undisturbed landscape (e.g. scattered buildings, a roadway, a utility easement). Large sections of the rail corridor pass through residential areas, many residences in which have lawns and other landscaping that extend to the edge of the rail bed. Roadways, including I-495 and the Massachusetts Turnpike, as well as smaller state highways and town roads, cross the rail corridor and create significant disturbance at these points. Various utilities (e.g. Tennessee Gas pipeline, Shell Oil Company pipeline, ComGas easement, high tension electric line) cross or, like AT&T's underground cables, US Telecom's fiber optics line, and various power lines, run along the rail corridor. In most cases, the utility disturbances affect railroad ballast. These situations are ranked as intermittently disturbed, and rated as having moderate potential for containing prehistoric sites.

C. Sensitivity Ranking

The predictive modeling for WCRE corridor is based on a matrix in which the four parameters discussed in previous section are displayed against each defined segment of the corridor. The resulting summary of segment characteristics is then used to assign an archaeological sensitivity value to each segment. The sensitivity values thus express the combined characteristics of each segment, implying differential probabilities for the existence of prehistoric sites along the rail corridor. At the same time, the sensitivity values imply different cultural-resource-management recommendations for the segments of the corridor. The model defines three overall sensitivity values, corresponding to three probabilities for the presence of prehistoric sites:

I.	High sensitivity	high probability of containing prehistoric sites
II.	Moderate sensitivity	moderate probability of containing prehistoric sites
III.	Low sensitivity	low probability of containing prehistoric sites

The four dimensions do not have the same logical or operational status in forming these sensitivity values. The first three dimensions -- distance from water, slope, soils -- are locational factors that refer to determinants of prehistoric site distribution at play during the formation of the archaeological record; in contrast, disturbance refers to post-depositional forces at work on the survival of those sites. Accordingly, the calculation of the sensitivity value for a given segment of the rail corridor uses the two kinds of dimensions in slightly different ways. The three sensitivity ratings are defined by the following rules:

I: The rating is I for all dimensions; or, the rating is I for two locational dimensions, II for the third, <u>and</u> is I or II for disturbance.

II: The rating is II for all dimensions; or the rating is II for two locational dimensions, I for the third, <u>and</u> is I or II for disturbance.

III: The rating is III for any locational dimension; or the rating is III for disturbance.

VII. MODELING EXPECTED HISTORIC CULTURAL RESOURCES

A. Models of Historic Development

Industrial, commercial and residential structures identified from documentary research and the site walkover suggest three broad patterns associated with the railroad corridor.

The first type of pattern forms a railroad-nucleated area, demonstrated by a concentration of structures clustered around the train depot. These structures take advantage of increased transportation and communication facilities, and increased general activities associated with the railroad. Thus land use within some towns was modified following the arrival of the railroad, and changes in the railroad system correlated directly with changes in the locations and uses of these structures. Structures in a railroad-nucleated area include railroad-owned facilities, similar to the engine houses, storage sheds, and depots, plus hotels. Examples appear on Walker's 1889 map of Framingham (Fig. IV-27). A railroad-nucleated area is also apparent in the mill village of Cordaville, which sprang up within a decade of the railroad's construction (Fig. IV-21). Because these types of sites and structures, to a greater and lesser degree, have been noted in the course of documentary research in each of the towns, they are expected in the archaeological records of most of the towns. Railroad junctions and depot locations therefore possess high sensitivity for historic archaeological resources.

The second type of pattern visible from documentary research is a resource-nucleated area, demonstrated by a concentration of structures clustered around significant resources or topographical features. Such resources and features may include rivers, streams, ponds, crossroads, quarries, river flood plains, trails, or turnpikes. The locations of sites in this environment may pre- or postdate the construction of the railroad. Their location may benefit from the construction of the railway without necessarily being a consequence of it. One such resource-nucleated area occurs at the town boundary between Westborough and Southborough. A blacksmith shop, grist mill, and dwelling are shown in this location, clustered at the intersection of unidentified roads and adjacent to the Sudbury River (Fig. IV-14). A second resource-nucleated area is apparent in the 1875 map of Ashland (Fig. IV-24). Here the junction of Concord and Fountain streets is close to the Sudbury River and to the south of the railroad line Fountain Street joins Union Street along the river bank. Yet neither location contained sites by the end of the nineteenth century. This observation suggests that resource nucleated sites are less dependent on the rail corridor for their existence than railroad-nucleated sites. They are therefore considered to possess moderate sensitivity for historic archaeological sites.

The third type of area is characterized as dispersed, and is typical of the agricultural lands, hilly terrain, and undeveloped areas that occur along the rail corridor. Although some sites will appear in dispersed areas, such as the D. Whitney dwelling shown at the edge of town on an early map of Westborough (Fig. IV-14), these areas have no causal link to the railroad and are therefore designated as low in sensitivity.

In addition to knowing where to expect historic archaeological sites, archaeologists must also assess post-depositional disturbance to these sites. Disturbance to historic sites along the rail corridor may arise from a variety of factors. Subsequent development in railroad-nucleated areas may result in an old structure's being razed and a new structure's being erected over the remains of the original. This type of disturbance is considered extensive and is ranked III, providing low potential for containing archaeological sites.

Or, as is argued for the village of Cordaville, building foundations can be filled with their own superstructures and the entire site regraded, essentially sealing the archaeological remains. This kind of activity creates moderate disturbance, because substantial architectural remains, such as foundation walls, and original floors may be extant underneath a fairly extensive layer of fill. This disturbance is ranked as II, providing moderate potential for archaeological sites.

Finally, some sites, particularly those in the dispersed areas away from subsequent development have experienced minimal or no disturbance. These are ranked as I, possessing high potential for archaeological sites.

B. Predictive Modeling of Historic Site Location

To generate a predictive model of historic sites, archaeologists analyzed historic maps for each of the seven towns, performed a site walkover of the entire railroad corridor, and studied town histories for references to the location of early residential, industrial, and commercial structures. This provided two types of information: the kinds of sites and features found in close proximity to the railroad, and the place along the corridor where archaeologists could expect sites to occur. Archaeologists then used this information to stratify the WCRE project corridor into areas of high, moderate, or low sensitivity, based on the observed patterns. These patterns were given numerical values from I to III, with I referring to high potential for archaeological sites.

During the walkover phase of the reconnaissance survey, archaeologists evaluated post-depositional disturbance along the rail corridor. Archaeologists ranked disturbance according to its severity, with I referring to no apparent disturbance, and III referring to extensive or total disturbance. To arrive at a final figure for archaeological sensitivity for historic period sites archaeologists considered both post-depositional disturbance and archaeological potential. Any site designated extensively disturbed was automatically ranked III - low potential for historic period archaeological sites. Sensitivity ratings were ultimately defined by the following rules:

I. The rating is I for both dimensions or the rating is I for site potential and II for disturbance.
II. The rating is II for site potential and I or II for disturbance.
III. The rating is III for sensitivity or disturbance.

VIII. MODELING RESULTS

Modeling of archaeological sensitivity addressed two distinct aspects of the WCRE project corridor. The first aspect is the sensitivity ranking along the edges of the linear rail corridor. The second aspect is archaeological sensitivity of the proposed stations.

A. Rail Corridor

The rail corridor itself lacks useful numbered divisions other than mile markers. The walkover phase of the reconnaissance survey divided the WCRE project corridor into segments according to obvious features such as road crossings, utility easement crossings, and river crossings. Each of these segments contained subsegments, defined by observed variation in topography and disturbance. The cartographic information on slope, soils, and distance from water were then factored into these segments and subsegments, to produce the sensitivity zones of the predictive model.

The discussion of each segment contains the following information:

- A listing of the known prehistoric sites located within 200 m. of the rail line, and of the historic structures older than 1900 located within 50 m. of the rail line. The information for the prehistoric sites is derived from the MHC prehistoric site files, and that for the historic structures from available maps.

- A map showing the segment itself, marked with the rail corridor, the segment divisions, and the sensitivity ratings for prehistoric and historic sites. The sensitivity ratings for prehistoric sites are marked on the north (on the left hand when in-bound) side, and that for historic on the south (on the right hand when in-bound) side, of the rail line.

- A table showing the values for the model dimensions for each segment of the rail corridor, and indicating the resulting sensitivity according to the rules defined above for both prehistoric and historic sites. In some cases, the variable and/or sensitivity ratings display two values separated by a slash (e.g. I/III), reflecting different conditions on each side of the rail corridor. In these cases, the first value refers to the north (on the left hand when in-bound) side, and the second to south (on the right hand when in-bound) side, of the rail corridor. The denotation II* under disturbance reflects the passage of the rail corridor through a cut in a hill slope.

1. Segment 1

Running approximately 2,250 m. from the Worcester terminal to Plantation Street (Worcester), this segment of the rail corridor passes through a cut along a wide rail bed with multiple sidings. The terrain on both sides of the cut is heavily built-up to the edge of the cut, or is heavily disturbed. The entire segment is treated as a single unit of low archaeological potential.

Known Prehistoric Sites

--None

Known Historic Sites

--Boston and Albany train yards and storage sheds; Richards 1898

Figure VIII-1 Section 1, archaeological sensitivity. Scale: 1 cm. = 250 m.

2. *Segment 2*

Running from Plantation Street to Hamilton Street (Worcester), the segment is approximately 1850 m. long and is divided into eight subsegments (2a-2h). The segment crosses fairly gentle terrain at the base of a steep slope, through which runs a seasonal stream that flows into Lake Quinsigamond to the east. The soils through most of the segment belong to the Chatfield-Hollis rock outcrop complex (Segment 2b-d), with smaller areas of udorthents (Segment 2a), and Woodbridge and Ridgebury extremely stony fine sandy loam (Segment 2e-h) also occurring. Disturbance is most noticeable in Segments 2c-d, where commercial buildings, a condominium development, and private houses abut the rail corridor.

Known Prehistoric Sites
--None

Known Historic Sites
--None

TABLE VIII-1: Plantation Street to Hamilton Street (Worcester)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
2a	III	I	III	II*	III	III	III
2b	III	I	III	I	III	III	III
2c	III	I	III	II/III	III	III	III
2d	III	I	III	III	III	III	III
2e	II	II	II	I	II	III	III
2f	I	II	II	I	II	III	III
2g	I	I	III	I	III	III	III
2h	II	I	II	II*	II	III	III

*Reflects the passage of the rail corridor through a cut in a hill slope.

Figure VIII-2 Section 2, archaeological sensitivity. Scale: 1 cm. = 250 m.

3. *Segment 3*

Running from Hamilton Street to Route 20 (Worcester), the segment is approximately 2,750 m. long and is divided into 11 subsegments (3a-3k). Through this segment, the rail corridor passes along the upper slope of the high hill that overlooks Lake Quinsigamond from the west. The steep slope down to the lake dominates the segment, the soils of which are similar to those in Segment 2. At the southern end of the segment, where the terrain flattens out, Hinckley sandy loam appears (Segment 3k). The rail corridor comes within 100 m. of Lake Quinsigamond (Segment 3g), but a very steep slope separates the rail line from the lake. A small stream crosses the rail corridor (Segment 3j) before emptying into the lake. Disturbance is most prominent in Segment 3h, where a large commercial building sits on a rail siding, and in Segment 3k, where commercial buildings front Route 20.

Known Prehistoric Sites

--None

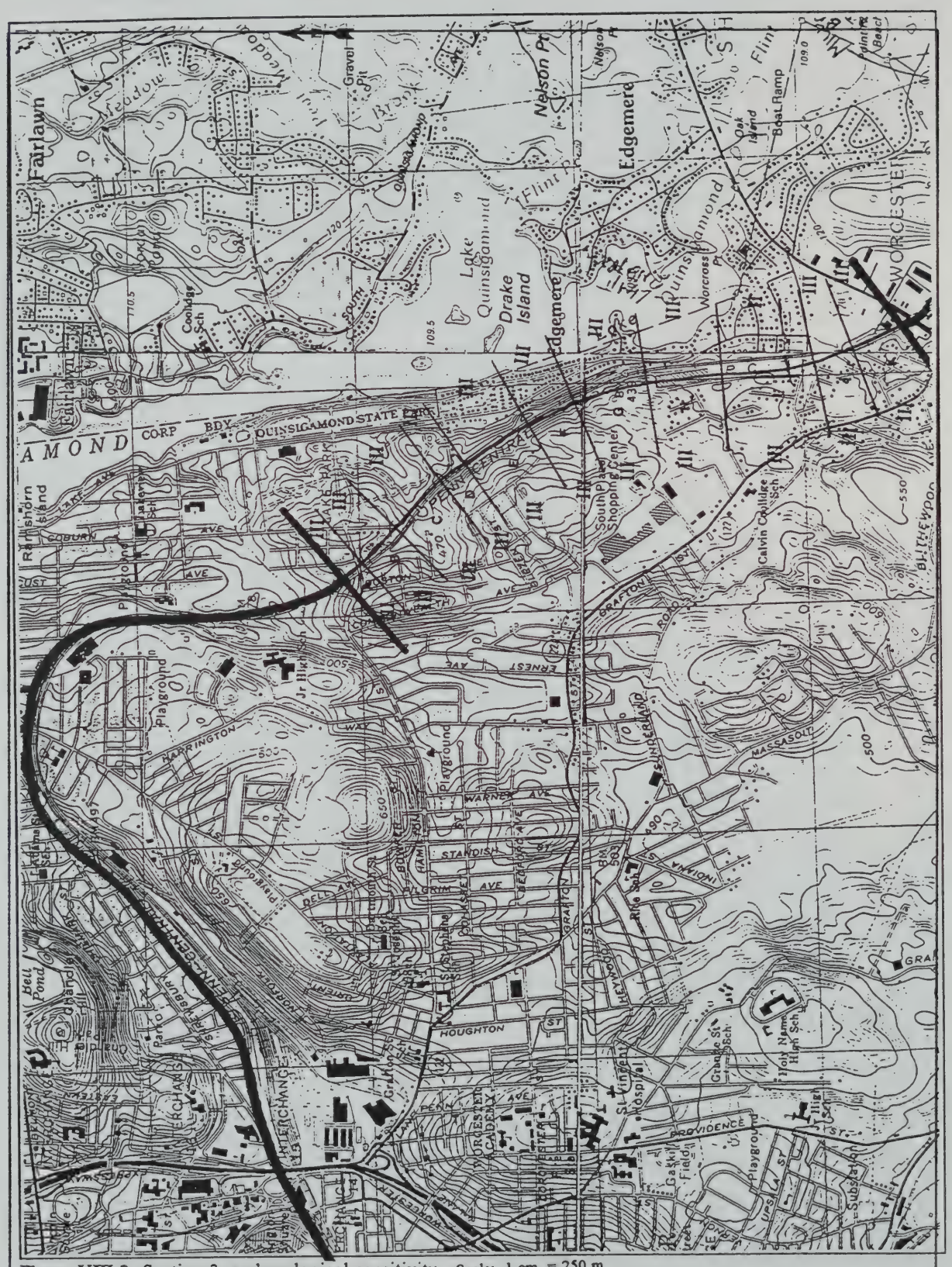
Known Historic Sites

--None

TABLE VIII-2: Hamilton Street to Route 20 (Worcester)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
3a	III	II	II	II*	III	III	III
3b	III	I	II	I	III	III	III
3c	III	II	II	I	III	III	III
3d	III	I	II	II	III	III	III
3e	III	III	II	II*	III	III	III
3f	II	III	II	II*	III	III	III
3g	I	III	II	II*	III	III	III
3h	II	II	II	III	III	III	III
3i	II	II	II	I	II	III	III
3j	I	II	III	I	III	III	III
3k	II	I	I	III	III	III	III

*Reflects the passage of the rail corridor through a cut in a hill slope.


Fairlawn
Meadow
Gravel Pit
Nelson Pt
Edgemere
Flint
Lake Quinsigamond
Drake Island
Quinsigamond
Boat Ramp
Oak Island
Worcester
Coolidge Sch
Calvin Coolidge Sch
South Land Shopping Center
QUINSIGAMOND STATE PARK
CORP BDY
Ramshorn Island
Playground
Jr High
HARRINGTON
WARNER AVE
STANDISH ST
PILGRIM AVE
HOUGHTON ST
GRAFTON ST
MASSASOIT
INDIANA
SUMMERLAND
BLITHEWOOD
PROVIDENCE ST
Holy Name High Sch
Grade St Sch
Tilly Sch
Substation
Bell Pond
Parkway
Cathedral Sch
Rice Sch
Hospital
Athletic Field
Playground
Bridge
Dam
Pond
Hill
Cemetery
Sewage Disp Plant
Pumping Station
Water Tank
Tower
Sta
Ch
Sch
Hosp
Bldg
Ruins
Rock
Pit
Quarry
Dump
Cemetery
Trail
Path
Road
Railroad
Power Line
Pipeline
Stream
Brook
Swamp
Marsh
Lake
Pond
Reservoir
Island
Point
Beach
Boat Ramp
Dock
Wharf
Pier
Jetty
Breakwater
Levee
Dam
Bridge
Culvert
Ford
Ferry
Landing
Airport
Runway
Hangar
Tower
Antenna
Radio
Radar
Weather Station
Observatory
Monument
Memorial
Park
Playground
Recreation
Golf Course
Cemetery
Church
Chapel
Temple
Synagogue
Mosque
Shrine
Grotto
Cross
Crucifix
Statue
Fountain
Spring
Well
Cistern
Reservoir
Tank
Silo
Barn
Stable
Shed
Garage
Warehouse
Factory
Mill
Foundry
Shop
Store
Office
Bank
Post Office
Library
Museum
Theater
Hall
Lodge
Club
Hotel
Motel
Inn
Restaurant
Cafe
Tavern
Gas Station
Service Station
Garage
Parking Lot
Parking Garage
Bus Station
Railroad Station
Airport
Heliport
Seaplane Base
Landing Strip
Runway
Taxiway
Apron

4. Segment 4

Running from Route 20 (Worcester) to Route 140 (Grafton), the segment is approximately 3,000 m. long and is divided into 14 subsegments (4a-4n). The terrain of this segment is broadly flat, interrupted by a small knoll in Segments 4c-d and by a sharper rise in Segment 4j-l. The proposed Millbury - Route 20 station would be located on the eastern slope of the first knoll. Wetlands are common through the segment, marking the fringes of Flint Pond to the north and Hovey Pond to the south; the rail corridor crosses the Quinsigamond River between these two bodies of water (Segment 4k). Most of the soils in the segment belong to the Canton, Whitman, and Woodbridge extremely stony fine sandy loam series (Segments 4c-e, g, l, m), the Freetown muck or ponded muck series (Segment 4f, k), or are udorthents (Segment 4a-b, h, j); Hinckley soils also occur (Segments 4i, n). Disturbance in the segment is extensive between Segments 4g and 4i, where large industrial and commercial facilities line the rail corridor.

Known Prehistoric Sites

--None

Known Historic Sites

--Segment 4g: Railroad station and depot at junction of Boston and Albany and Millbury Branch Railroad, on both sides of rail corridor; Beers 1870, New York Publishing House 1878.

--Segment 4k: The Bay State Ice Company; Richards 1898.

TABLE VIII-3: Route 20 (Worcester) to Route 140 (Grafton)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
4a	II	I	III	III	III	III	III
4b	I	I	III	III/I	III	III	III
4c	I	II	III	II*	III	III	III
4d	II	II	II	II*	II	III	III
4e	I	I	II	I	I	III	III
4f	I	I	III	I	III	III	III
4g	I	I	II	I/II	I	I	I/II
4h	II	I	III	III	III	III	III
4i	I	I	I	III	III	III	III
4j	II	I	III	I	III	III	III
4k	I	I	III	III	III	III	III
4l	I	I	III	I	III	III	III
4m	II	I	II	II*	II	III	III
4n	III	II	I	II*	III	III	III

* Reflects the passage of the rail corridor through a cut in a hill slope.

Figure VIII-4 Section 4, archaeological sensitivity. Scale: 1 cm. = 250 m.

5. *Segment 5*

Running from Route 140 to Pine Street (Grafton), the segment is approximately 2,500 m. long and is divided into 10 subsegments (5a-5j). The terrain through which the rail corridor passes is broadly level, marked by low knolls in Segments 5c and 5j. Big Bummet and Summit brooks cross the rail corridor in Segments 5c-d, and the wetlands that fringe these streams extend to Segment 5g. The headwaters of Axtell Brook approach the rail corridor in Segment 5j. The soils of the segment include the Hinckley series (Segments 5a-b, d-e), Whitman, Scituate, and Canton extremely stony fine sandy loams (Segments 5f-j), and Freetown muck (Segment 5c). Notable disturbance is limited to grading for private residences (Segment 5b and 5g).

Known Prehistoric Sites

--Segment 5c-d: 19-WR-117; Late Archaic/Woodland, small village; MHC prehistoric site files.

Known Historic Sites

--Segment 5a: Westboro Savings Bank, dwellings; Richards 1898.

--Segment 5b: Railroad depot, freight house, coal shed; Richards 1898.

TABLE VIII-4: Route 140 to Pine Street (Grafton)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
5a	III	I	I	II	III	III	III
5b	II	I	I	I/III	II/III	I	I/III
5c	I	II	III	I	III	III	III
5d	I	I	I	I	I	III	III
5e	I	I	I	I	I	III	III
5f	II	I	II	I	II	III	III
5g	I	I	III/II	III/I	III/I	III	III
5h	II	I	II	I/II	II	III	III
5i	II	I	II/III	I	II/III	III	III
5j	I	II	II	II*	II	III	III

*Reflects the passage of the rail corridor through a cut in a hill slope.

Figure VIII-5 Section 5, archaeological sensitivity. Scale: 1 cm. = 250 m.

6. *Segment 6*

Running from Pine Street (Grafton) to Arch Street (Westborough), the segment is approximately 2,650 m. long and is divided into 10 subsegments (6a-6j). The segment passes through a cluster of knolls that separate the Blackstone and Merrimack drainages. The soils of the segment include Paxton and Windsor fine sandy loams (Segments 6b, f-g), as well as Woodbridge, Paxton, and Canton extremely stony fine sandy loam (Segment 6a, c-d, h), Chatfield-Hollis rock outcrop complex (Segment 6i), and Freetown muck (Segment 6e, j). The only notable disturbance along the rail corridor is grading associated with private residences and a landscaping firm in Segment 6b.

Known Prehistoric Sites

--None

Known Historic Sites

--Segment 6j: A shoe-lace factory; Richards 1898.

TABLE VIII-5: Pine Street (Grafton) to Arch Street (Westborough)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
6a	I	I	II	II*	I	III	III
6b	II	I	I	III/I	III/I	III	III
6c	III	II	II	I	II	III	III
6d	II	II	II	I	II	III	III
6e	I	II	III	I	III	III	III
6f	I	II	I	II*	I	III	III
6g	I	II	I	I	I	III	III
6h	II	III	II	II*	III	III	III
6i	I	II	II	II*	II	III	III
6j	I	I	III	I	III	I	I

*Reflects the passage of the rail corridor through a cut in a hill slope.

Figure VIII-6 Section 6, archaeological sensitivity. Scale: 1 cm. = 250 m.

7. *Segment 7*

Running from Arch Street to Otis Street (Westborough), the segment is approximately 1,750 m. long and is divided into nine subsegments (7a-7i). The segment borders several knolls and low rises of ground that separate Hocomonco Pond to the north from wetlands emponded by the George H. Nichols Dam to the south.

The soils of the segment include Hinckley and Merrimack sandy loams (Segments 7b, d, h, i), Paxton extremely stony fine sandy loam (Segment 7a), and Walpole fine sandy loam and Freetown muck (7c, e-g). Disturbance is extensive throughout the segment, and includes a large sanding operation north of the rail line (Segments 7b-d), the flooding created by the dam south of the rail line (Segments 7c-e), the construction and repair to the Fisher Street bridge (Segment 7e-f), and the grading for a ball field and a disused rail spur north of the rail line (Segments 7f-h).

Known Prehistoric Sites

--Segment 7d: 19-WR-277; Late Archaic/Early Woodland (Brewerton, Otter Creek, Vosburg, Small Stemmed, Small Triangle), near Hocomonco Pond; Hoffman 1982.

--Segment 7e-f: 19-WR-207; no description, near Hocomonco Pond; MHC prehistoric site files.

--Segment 7g-h: 19-WR-204; no description, near Hocomonco Pond; MHC prehistoric site files.

Known Historic Sites

--None

TABLE VIII-6: Arch Street to Otis Street (Westborough)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
7a	I	III/I	I	II*	III/I	III	III
7b	I	III/I	I	III/I	III/I	III	III
7c	I	I	III	III	III	III	III
7d	I	I	I	III	III	III	III
7e	I	I	III	I/III	III	III	III
7f	I	I/III	III	III	III	III	III
7g	II	I	III	I/III	III	III	III
7h	III	I	I	I	III	III	III
7i	III	I	I	II*	III	III	III

*Reflects the passage of the rail corridor through a cut in a hill slope.

Figure VIII-7 Section 7, archaeological sensitivity. Scale: 1 cm. = 250 m.

8. Segment 8

Running from Otis Street to Main Street (Westborough), the segment is approximately 2,650 m. long and is divided into 13 subsegments (8a-8m). The rail corridor crosses a broadly flat terrain marked by several low knolls in its eastern end. The soils of the segment form a mosaic of Merrimack, Paxton, and Hinckley sandy loams (Segment 8a, e-f, h-i, k), Sudbury sandy loam, Canton extremely stony sandy loam, and Chatfield-Hollis rock outcrop complex (Segment 8b, c, l), and Whitman and Walpole sandy loams, Ridgebury extremely stony sandy loam, and urban soils (Segment 8d, g, j, m). The disturbance in the segment includes an industrial complex and power line easement at its western end (Segment 8a-b), grading and commercial buildings around the Milk Street bridge (Segments 8g-h), and graded residential properties in its eastern end (Segment 8k).

Known Prehistoric Sites

--Segment 8e: 19-WR-538; Late Archaic (Atlantic), surface collected; MHC prehistoric site files.

Known Historic Sites

--Segment 8e: J. Parker Saw and Gristmill; Fisher 1837.

--Segments 8k-m: Scattered dwellings and a school; Beers 1870, Richards 1898.

TABLE VIII-7: Otis Street to Main Street (Westborough)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
8a	III	I	I	III	III	III	III
8b	III	I	II	III	III	III	III
8c	III	I	II	I	III	III	III
8d	II	I	III	I	III	III	III
8e	I	I	I	I	I	II	II
8f	II	I	I	I	I	III	III
8g	I	I	III	III	III	III	III
8h	I	II	I	I/III	I/III	III	III
8i	I	II	I	I	I	III	III
8j	I	I	III	I	III	III	III
8k	II	I	I	III	III	II	III
8l	III	II	II	II*	III	II	II
8m	II	II	III	II*	III	II	II

*Reflects the passage of the rail corridor through a cut in a hill slope.

Figure VIII-8 Section 8, archaeological sensitivity. Scale: 1 cm. = 250 m.

9. *Segment 9*

Running from Main Street to Fruit Street (Westborough), the segment is approximately 4,900 m. long and is divided into 16 subsegments (9a-9p). This segment crosses the thickly developed zone of Westborough through an industrial area in which occur urban Hinckley soils, udorthents, and extensive disturbance (Segments 9a-c). The segment then crosses Cedar Swamp, which contains both the Freetown ponded muck of the open wetland areas (Segments 9d, f, h) and the Agawam and Paxton fine sandy loam of forested glacial knolls (Segments e, f, g, i). The recorded prehistoric sites, as well as the site observed during the walkover, occur on these knolls. The rail corridor then crosses a mosaic of Merrimack fine sandy loam (Segments 9l, n), Ninigret fine sandy loam (Segment 9k), and Ridgebury extremely stony sandy loam and Freetown muck (Segments 9j, m). The segment ends in the Freetown ponded muck (Segments 9o-p) of the wetlands that mark the eastern boundaries of Cedar Swamp and the origins of the Sudbury River. The sidings for Conrail's automobile facility (Segments j-m), the I-495 overpass (Segment 9n), and the siding for the Cumberland Farms distribution center and the Massachusetts Turnpike overpass (Segment 9o) have created extensive disturbance in this part of the segment.

Known Prehistoric Sites

--Segment 9a: 19-WR-436; Late Archaic (Atlantic); in Cedar Swamp Archaeological District.

--Segment 9c: 19-WR-365; Late Archaic/Early Woodland (Small Stemmed, Small Triangle); in Cedar Swamp Archaeological District.

--Segment 9e: 19-WR-410; quartz core and flake; in Cedar Swamp Archaeological District.

--Segment 9g: 19-WR-408; two quartzite flakes; in Cedar Swamp Archaeological District.

--Segment 9i: 19-WR-366; Late Archaic (Brewerton, Orient, Small Triangle, Small Stemmed); surface collected (Farrell collection), in Cedar Swamp Archaeological District.

19-WR-417; five pieces of quartz and quartzite debitage, undated; in Cedar Swamp Archaeological District.

19-WR-418; multicomponent site (Small Stemmed, Small Triangle, Orient/Wayland, Vinette I pottery; radiocarbon date 2265 +/-155 BP); in Cedar Swamp Archaeological District; Hoffman 1989.

19-WR-419; Late Archaic (Brewerton, Small Stemmed); in Cedar Swamp Archaeological District.

19-WR-420; Late Archaic/Early Woodland (Small Stemmed); in Cedar Swamp Archaeological District; Hoffman 1989.

19-WR-434; quartz cores and knife, undated; in Cedar Swamp Archaeological District.

19-WR-435; a grooved ax, undated; in Cedar Swamp Archaeological District.

--Segment 9m-n: 19-WR-258; Late Archaic/Early Woodland (Small Stemmed point), surface-collected, in Cedar Swamp Archaeological District; MHC prehistoric site files.

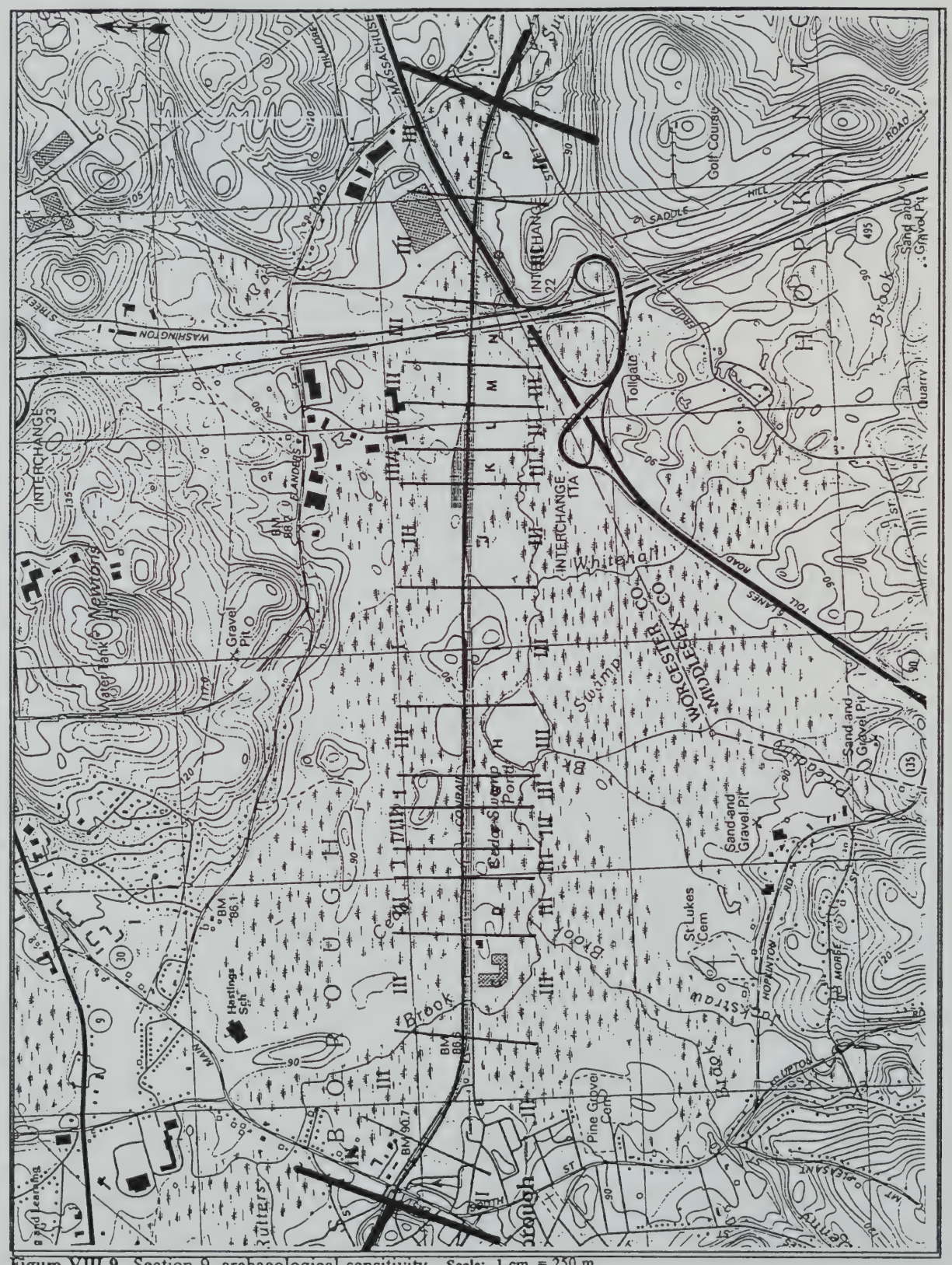
Known Historic Sites

--Segment 9o-p: Blacksmith's shop (1830s); Fisher 1837, Beers 1870.

TABLE VIII-8: Main Street to Fruit Street (Westborough)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
9a	I	I	III	III	III	III	III
9b	I	I	III	I/III	III	III	III
9c	I	I	III	III	III	III	III
9d	I	I	III	I	III	III	III
9e	I	I	I	II*	I	III	III
9f	I	I	I/III	I	I/III	III	III
9g	I	I	I	I	I	III	III
9h	I	I	III	I	III	III	III
9i	I	I	I	II*	I	III	III
9j	I	I	III	III	III	III	III
9k	I	I	II	III/I	III/I	III	III
9l	I	I	I	III/I	III/I	III	III
9m	I	I	III	III	III	III	III
9n	I	I	I	III	III	III	III
9o	I	I	III	III	III	II	III
9p	I	I	III	I	III	II	II

*Reflects the passage of the rail corridor through a cut in a hill slope.


INTERCHANGE 23
Water Tank
Newton's
Gravel Pit
WASHINGTON STREET
BLANDERS
BM 88.9
MASSACHUSETTS
INTERCHANGE 22
INTERCHANGE 11A
Golf Course
SADDLE HILL ROAD
Tollgate
TOLL GATE ROAD
Whitehall
WORCESTER CO.
MIDDLESEX CO.
Sand and Gravel Pit
Quarry
Brook
Cedar Swamp Pond
Sand and Gravel Pit
St Lukes Cem
Hastings Sch
BM 86.1
MAIN
Brook
BM 88.6
BM 90.7
Pine Grove Cem
Brook
Brook
Brook

10. Segment 10

Running from Fruit Street (Westborough) to Cordaville Street (Southborough), the segment is approximately 2,500 m. long and is divided into seven subsegments (10a-10g). The rail corridor parallels the Sudbury River and its fringing wetlands, running north of the river along level ground between low knolls. The soils of the segment from a mosaic of Merrimack and Hinckley sandy loams (Segments 10b, f), Ninigret fine sandy loam (Segment 10d), and Woodbridge very stony loam, Saco silt loam, Walpole fine sandy loam, and udorthents (Segments 10a, c, e, f). Disturbance in the segment is limited to grading for commercial buildings (Segments c-d) and the udorthents associated with the Cordaville mill complex (Segment 10g).

Known Prehistoric Sites

--None

Known Historic Sites

--Segment 10a: Grist and plaster mill (1870s), dwellings; Fisher 1837, Beers 1870, Allen 1984.

--Segment 10b: Dwelling; Beers 1870.

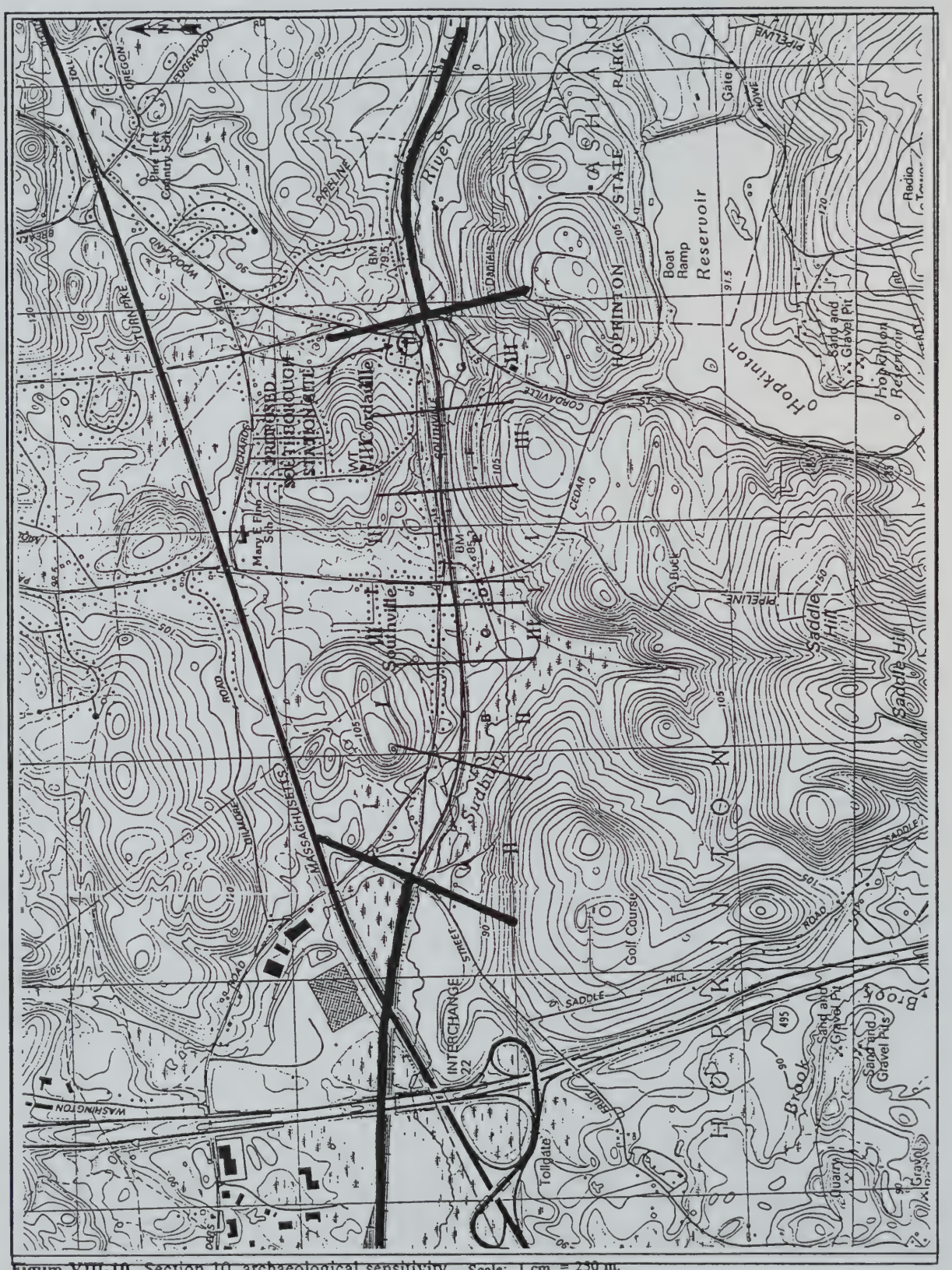
--Segment 10d-e: Southville industrial village; Beers 1870, Richards 1898.

--Segment 10g: Mill village (Cordaville); Beers 1870, Richards 1898.

TABLE VIII-9: Fruit Street (Westborough) to Cordaville Street (Southborough)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
10a	I	I	II	I	I	II	II
10b	I	I	I	I	I	II	II
10c	I	I	III	II	III	III	III
10d	I	I	II	II	I	I	I
10e	I	I	III	I	III	I	I
10f	I	I	I/III	I	I/III	III	III
10g	I	I	III	III	III	I	III*

*See the discussion under the proposed Southborough Station site, Section VIII.B.5.


Boat Ramp
Reservoir
Hopkinton
Sand and Gravel Pit
Hopkinton Reservoir
Saddle Hill
Golf Course
Tollgate
INTERCHANGE 22
Southville
Sudbury
Mt. Pleasant
Brook
Quarry
Sand and Gravel Pits
Gate
Radio Tower
Mary E Fine Sch
Dist Tel Country Sch
Wood Land
Edgewood
Oregon
Pipeline
Duck
Cedar
Corporation
Richards
Massachusetts
Washington
Turnpike
Saddle Hill Road
Saddle Hill Street
Howe
Dantels
Gilmore
Bridge
Ferry
Road
Street
Hill
Saddle
Pipeline
Toll
Gate
Park
State
Hopkinton
Sudbury
Southville
Mt. Pleasant
Brook
River
Reservoir
Radio Tower
Sand and Gravel Pit
Sand and Gravel Pits
Quarry
Gravel Pit
Tollgate
Golf Course
Saddle Hill
Hopkinton Reservoir
Boat Ramp
Gate
Pipeline
Duck
Cedar
Corporation
Richards
Mary E Fine Sch
Dist Tel Country Sch
Wood Land
Edgewood
Oregon
Toll
Turnpike
Massachusetts
Washington
Gilmore
Bridge
Ferry
Road
Street
Hill
Saddle
Pipeline
Dantels
Howe

11. Segment 11

Running from Cordaville Street (Southborough) to Howe Street (Ashland), the segment is approximately 2,000 m. long and is divided into nine subsegments (11a-11i). The topography of the segment is similar to that of Segment 10; the rail corridor crosses to the right bank of the Sudbury River in Segment 11g-h. The soil mosaic includes Agawam and Hinckley sandy loams (Segment 11c-f, i), Canton extremely stony fine sandy loam (Segment 11g-h), Saco silt loam, Walpole fine sandy loam, and udorthents (Segment 11a, b, c, e, g). Notable disturbance occurs only at each end of the segment, with the Cordaville mill complex in the west (Segment 11a) and a sand quarry in the east (Segment 11i).

Known Prehistoric Sites
--None

Known Historic Sites
--Segment 11a: Mill village (Cordaville); Beers 1870, Richards 1898.
--Segment 11h: Aldrich mills; Beers 1875.

TABLE VIII-10: Cordaville Street (Southborough) to Howe Street (Ashland)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
11a	I	I	III	III	III	I	III
11b	I	I	III	I	III	II	II
11c	I	I	I/III	I	I/III	III	III
11d	I	I	I	II*	I	III	III
11e	I	I	I/III	II*	I/III	III	III
11f	I	I	I	I	I	III	III
11g	I	I	II/III	I	I/III	III	III
11h	I	I/II	II	I	II	II	II
11i	I	I	I	I/III	I/III	III	III

*Reflects the passage of the rail corridor through a cut in a hill slope.

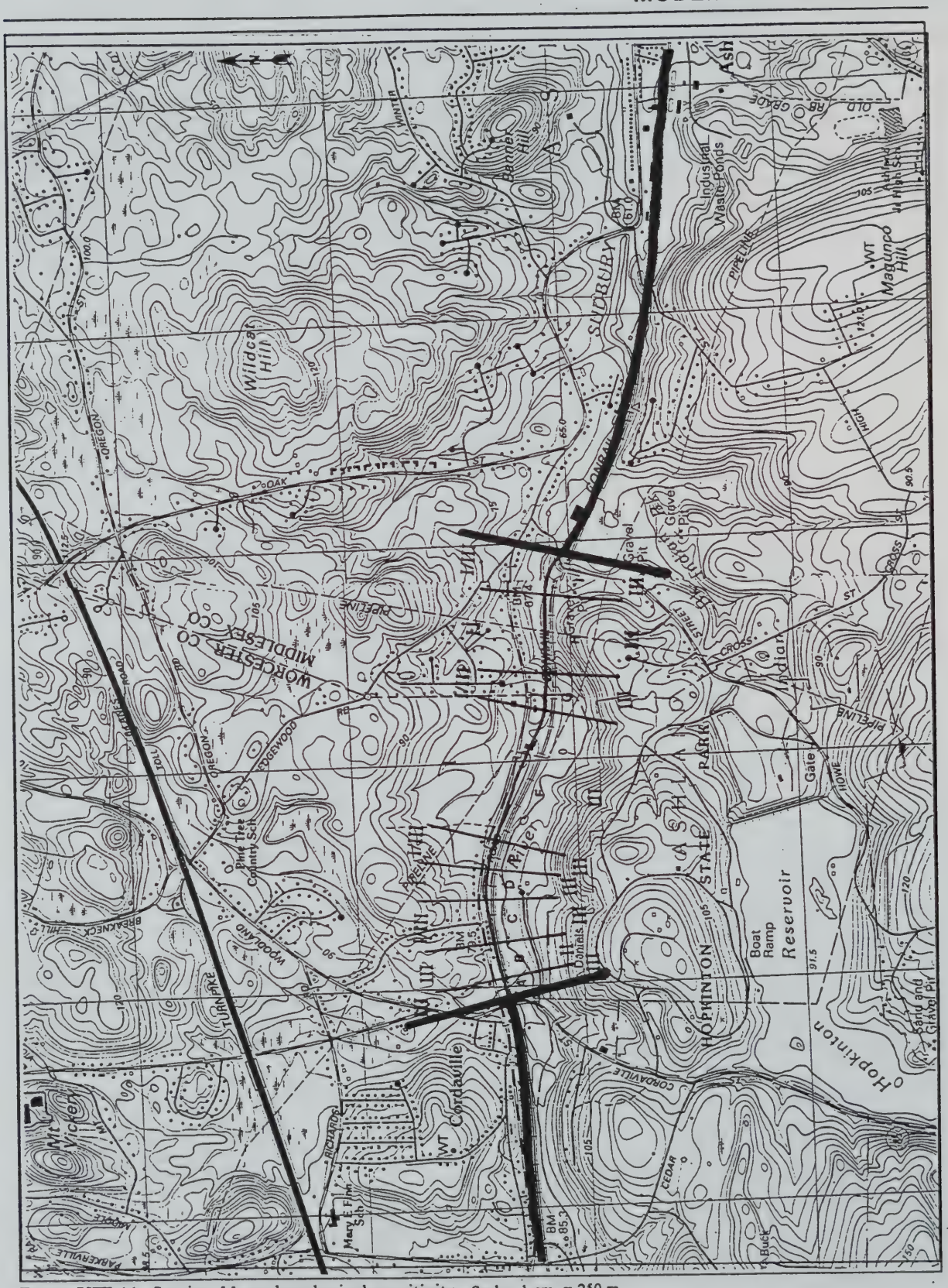


Figure VIII-11 Section 11, archaeological sensitivity. Scale: 1 cm. = 250 m.

12. Segment 12

Running from Howe Street to Main Street (Ashland), the segment is approximately 2,900 m. long and is divided into 12 subsegments (12a-12l). The rail corridor parallels the right bank of the Sudbury River, passing through a terrain similar to that found in Segments 10 and 11; the Sudbury floodplain opens up somewhat in the eastern end of the segment, providing space for the Ashland town center. Indian Brook joins the Sudbury from the south in Segment 12a. The soils of the segment are somewhat less variable, and more disturbed, than those of the previous two segments; these soils include Merrimack urban land complex (Segment 12e-h), Rainbow silt loams (Segment 12b, c), and udorthents (Segment 12a, d, i-l). Disturbance covers the eastern half of the segment; beginning at the point where Oak Street approaches the rail line, commercial and industrial buildings abut the rail corridor.

Known Prehistoric Sites

--Segment 12g-h: 19-MD-226; no description available; MHC prehistoric site files.

Known Historic Sites

--Segments 12f-g: Dwellings; Beers 1875.

--Segments 12k-l: Railroad depot and other facilities; Beers 1875.

TABLE VIII-11: Howe Street to Main Street (Ashalnd)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
12a	I	I	III	I/III	III	III	III
12b	I	II	II	I	II	III	III
12c	I	II	III	II*	III	III	III
12d	I	I	III	I	III	III	III
12e	I	II	I	II*	I	III	III
12f	I	I	I	I	I	II	II
12g	II	I	I	III/I	III/I	II	II/III
12h	II	I	I	III	III	III	III
12i	I	I	III	III	III	III	III
12j	II	I	III	III	III	III	III
12k	III	I	III	I	III	I	I
12l	III	I	III	III	III	I	III

*Reflects the passage of the rail corridor through a cut in a hill slope.

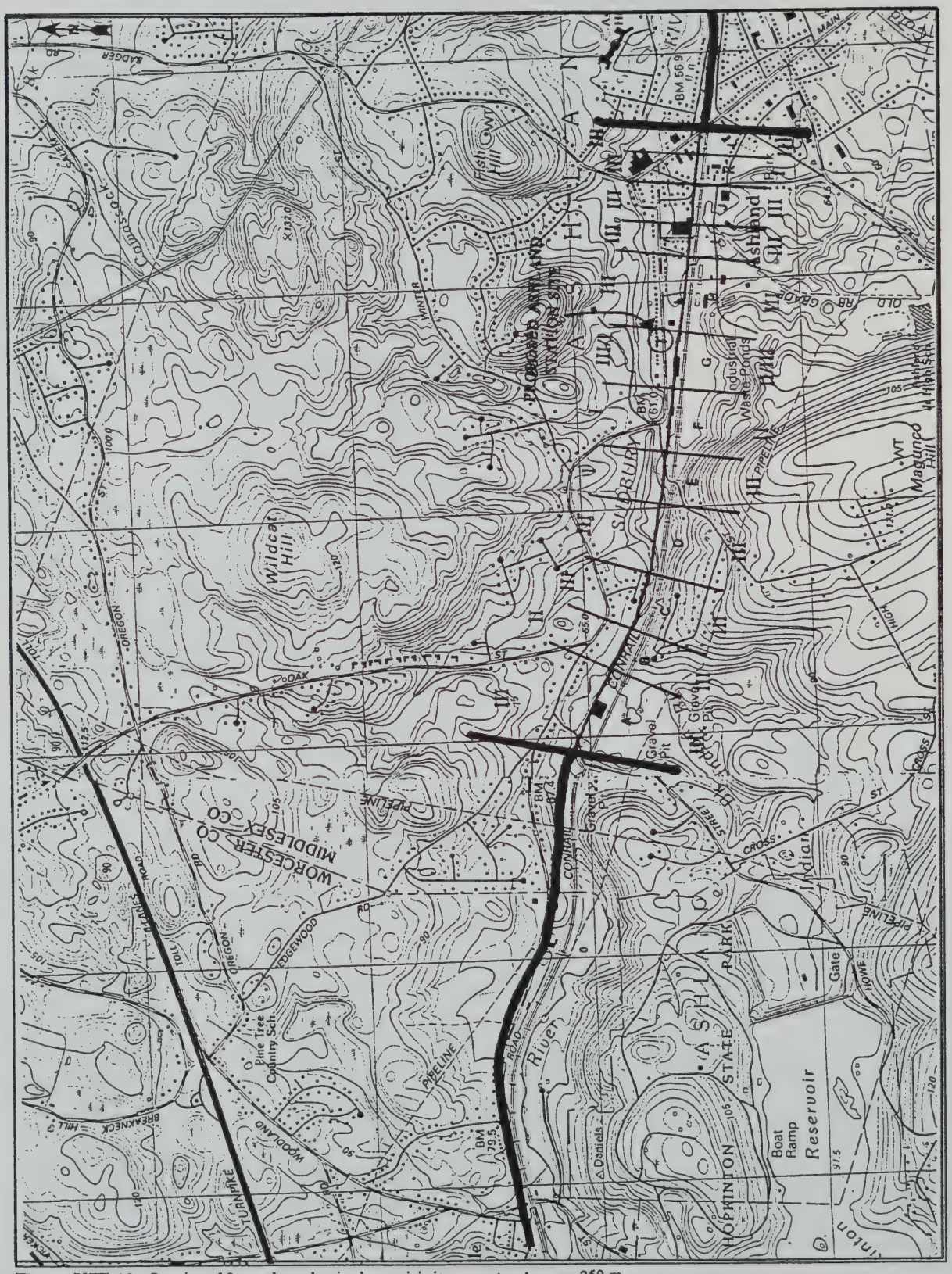


Figure VIII-12 Section 12, archaeological sensitivity. Scale: 1 cm. = 250 m.

13. Segment 13

Running from Main Street (Ashland) to Winter Street (Framingham), the segment is approximately 4,750 m. long and is divided into 15 subsegments (13a-13o). The rail corridor follows the Sudbury River, crossing it twice in Segments 13d-f, before swinging eastward in Segment 13i-j and leaving the river. The river itself has been extensively dammed to create a chain of reservoirs and mill ponds. Cold Spring Brook enters the river from the south in Segment 13d. The soils of the segment reflect their urban setting, consisting of limited areas of Canton sandy loam and Scio-Urban land complex (Segment 13g, i), and of Pootatuck sandy loam, Charlton and Narragansett extremely stony sandy loams, with Haven-Urban land complex (Segment 13f, h, j). The greater part of the segment is composed of udorthents and urban soils (Segment 13a-d, k-o). These soils reflect the virtual continuous disturbance to the segment, created by grading for residences, commercial and industrial buildings, the reservoir system on the Sudbury, and the rail yard.

Known Prehistoric Sites

--Segment 13f:	19-MD-540; surface collection, 2 quartz flakes, one sherd; MHC prehistoric site files.
--Segment 13l:	19-MD-383; Contact period fishing location; Temple 1887:21,42.
--Segment 13o:	19-MD-359; Contact period burial ground (but may be located further north); Temple 1887:43-44.

Known Historic Sites

--Segment 13j:	Dwellings at intersection of Winter Street and Old Central Turnpike,\; Walling 1872.
--Segments13l-o:	Multiple structures and facilities along both side of railroad tracks, including railroad sheds, storage areas, Boston and Albany Railroad Hotel, J. J. Clarke's Store and Tavern, and possibly Nathaniel Eames homestead; Nixon 1832, Temple 1887, Walling 1872, Walker 1889, Bailey 1898.

TABLE VIII-12: Main Street (Ashland) to Hollis Street (Framingham)

Section	Existing Conditions				Prehistoric	Historic	
	Water	Slope	Soils	Disturbance	Sensitivity	Site Potential	Sensitivity
13a	III	I	III	III	III	III	III
13b	II	I	III	III	III	III	III
13c	I	I	III	III	III	III	III
13d	II	I	III	III	III	III	III
13e	I	I	III	III	III	III	III
13f	I	I	II	I/II	I	III	III
13g	I	I	I	I/III	I/III	III	III
13h	I	I/III	II	II/III	I/III	III	III
13i	I	I	I	III	III	III	III
13j	II	I	II	III	III	II	III
13k	III	I	III	III	III	III	III
13l	II	I	III	III	III	I	III
13m	I	I	III	III	III	I	III
13n	II	I	III	III	III	I	III
13o	III	I	III	III	III	I	III

Figure VIII-13 Section 13, archaeological sensitivity. Scale: 1 cm. = 250 m.

B. Proposed Stations

1. Millbury Station -- Route 122 (Fig. VIII-14)

The proposed station location occupies broadly level ground within 50 m. of vegetated wetland. While some disturbance is apparent immediately east of the proposed station location, no significant disturbance is evident in the proposed station area itself. These characteristics confer a high probability that the proposed station area contains prehistoric sites.

The proposed access road crosses an extremely variable terrain, most of which is very rough, rocky, and steep, with large of areas of disturbance. Even though a stream with vegetated wetland fringe flows across the proposed access road, the topographic setting confers a low probability that the northern 200 m. contains prehistoric sites. The southern 100 m. of the proposed access road crosses the broadly flat top of a knoll before dropping steeply to the north. This section of the proposed access road has a higher potential for containing prehistoric sites.

According to historical research, very little development occurred in this portion of the project corridor. The nearest historical development was located at the junction of the Boston and Albany Railroad line and the Millbury Branch Railroad line, further to the east. The proposed Millbury Station -- Rte. 122 site is therefore not sensitive for historic archaeological sites.

2. Millbury Station -- Route 20 (Fig. VIII-15)

The proposed station location occupies broadly level terrain on the eastern side of a rocky knoll, overlooking a vegetated wetland. No significant disturbance is evident in the proposed station area. These topographical characteristics confer a high probability that the proposed station area contains prehistoric sites. The proposed station-access road crosses an industrial parking lot before cutting through the rocky knoll. The existing disturbance of the parking lot, and the steeper slope and rocky soils of the knoll confer a low probability that these sections of the proposed access road contain prehistoric sites. However, the eastern 100 m. of the access road shares the characteristics of the proposed station, and has a similarly high likelihood of containing prehistoric sites.

According to historical research, very little development occurred in this portion of the project corridor. The nearest historical development was located at the junction of the Boston and Albany Railroad line-and the Millbury Branch Railroad line, further to the east. The proposed Millbury Station -- Rte. 20 site is therefore not sensitive for historic archaeological sites.

3. Grafton Station (Fig. VIII-16)

The location of the proposed Grafton station is a gently sloping height of land through which the existing rail bed cuts. A small area of wetland vegetation occurs just north of the station area, while the more extensive wetlands of Axtell Brook lie 150-300 m. away. The proposed station area provides no obvious indication of disturbance, other than the existing rail bed and cut; archaeological monitoring observed no obvious disturbance in the back-hoe excavations undertaken for the hazardous materials investigation. According to these site characteristics, the proposed Grafton station area possesses a moderate to high probability of containing

prehistoric sites. The proposed station location is not, however, sensitive for historic archaeological sites, the majority of which are located further to the west along the rail bed, at High Street and Shrewsbury Street.

4. *Westborough Station (Fig. VIII-17)*

The proposed Westborough station would occupy broadly level terrain within about 200 m. of Hocomonco Pond and other smaller bodies of water; a swale that contains hydric soils and wetland vegetation borders the proposed station area to the east. The proposed station area lies within a relatively dense cluster of known prehistoric and Contact period archaeological sites. In addition to the prehistoric sites previously listed above for Segment 7 of the rail corridor, the MHC site files contain additional prehistoric and Contact period sites around Hocomonco Pond. Moreover, the Westborough Historical Commission has a small collection of prehistoric objects (two quartzite flakes and a possible quartz shatter) that were found in April 1993 in the northeastern section of the station area. These characteristics and observations imply that the proposed station area presents a high probability of containing prehistoric or Contact period sites. From a historic perspective, this portion of the WCRE project corridor falls into the dispersed pattern, with low sensitivity for historic period sites.

The proposed station location is heavily disturbed. The rail corridor runs along the southern border of the station area, and while Smith Valve Parkway bounds it to the north. Two landscaped ball fields lie to the west, while the wetland zone lies to the east. The station area itself has been heavily remodeled, with the forest cover and topsoil removed across the western and central portions of the site. To the east, the remodelling ends with a steep, low artificial bluff overlooking the hydric soils of the wetland. An overgrown paved road runs along the eastern edge of the bluff, while a derelict railroad siding and a dirt road runs across the location. Archaeological monitoring of the back-hoe excavations conducted for the hazardous materials investigation observed the remains of a small railroad trestle with earthen fill in one excavation, and extensive disturbance in the others. Remains of the railroad trestle are apparent across Smith Valve Parkway, north of the proposed station location. Prehistoric and shallow pre-railroad historic sites are unlikely to have survived the construction of these railroad facilities and the associated grading.

5. *Southborough Station (Fig. VIII-18)*

The proposed Southborough station is located on the site of the Sanford mill. Remains of the mill site are still visible east of the station location, while residences associated with the factory are extant along Southville Road. Other parts of the mill site are now buried under a fill of stone slabs and earth. Construction of the Sanford mill and associated housing deeply and extensively disturbed the original landscape, and probably destroyed any prehistoric or earlier historic archaeological sites in the proposed station area.

Archaeological monitoring of back-hoe excavations conducted for the hazardous materials study indicated up to 12 ft. of fill over some parts of the mill. An early photograph of the Cordaville Mills shows the mill buildings on a level with the railroad track, while today the railroad track is approximately five ft. above the level of the site (Fig. IV-29; Freeman 1928). However, the site is not uniform or level and the grade is steeper on the eastern portion of the site than at the mill pond boundary. The evidence thus suggests fairly extensive grading of ground surfaces and considerable filling, at least in some portions of the site. This fill may cover and protect cellars and floors under the two largest factory buildings.

6. *Ashland (Fig. VIII-19)*

The area in which the proposed Ashland station is to be built contains the topographical characteristics favorable to the presence of prehistoric sites, and the MHC prehistoric site files record a site in the area (see Segment 12 above). At the same time, the proposed station area falls within 300 m. of a high-sensitivity zone for historic sites, and the Beers (1875) map of Ashland marks several residences between Pleasant Street and the railroad in this vicinity (Fig. IV-24). However, construction of the railroad bed and associated building in the nineteenth and early twentieth centuries, and more recent commercial and industrial development have extensively disturbed the proposed station area.

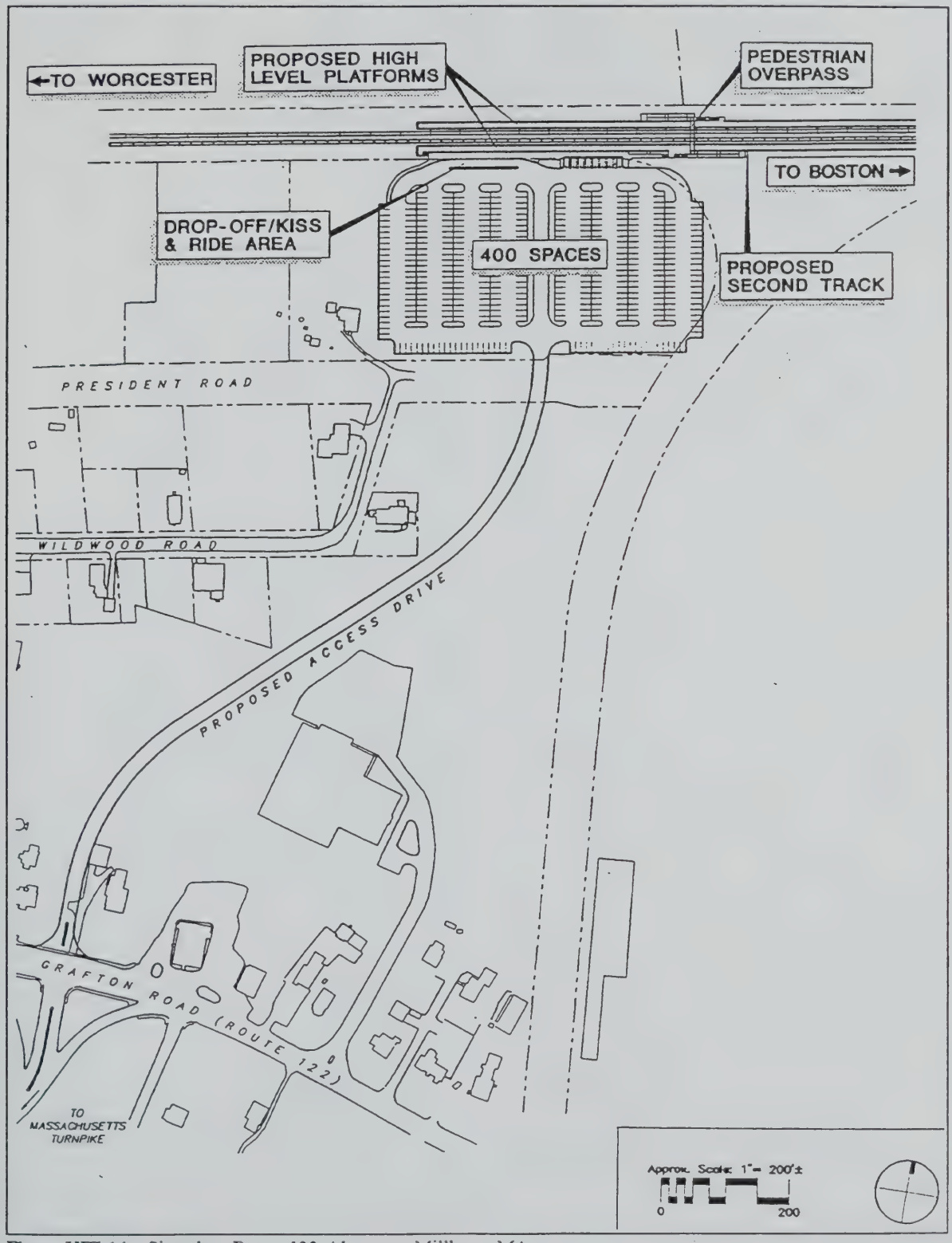


Figure VIII-14 - Site plan, Route 122 Alternate, Millbury, MA.

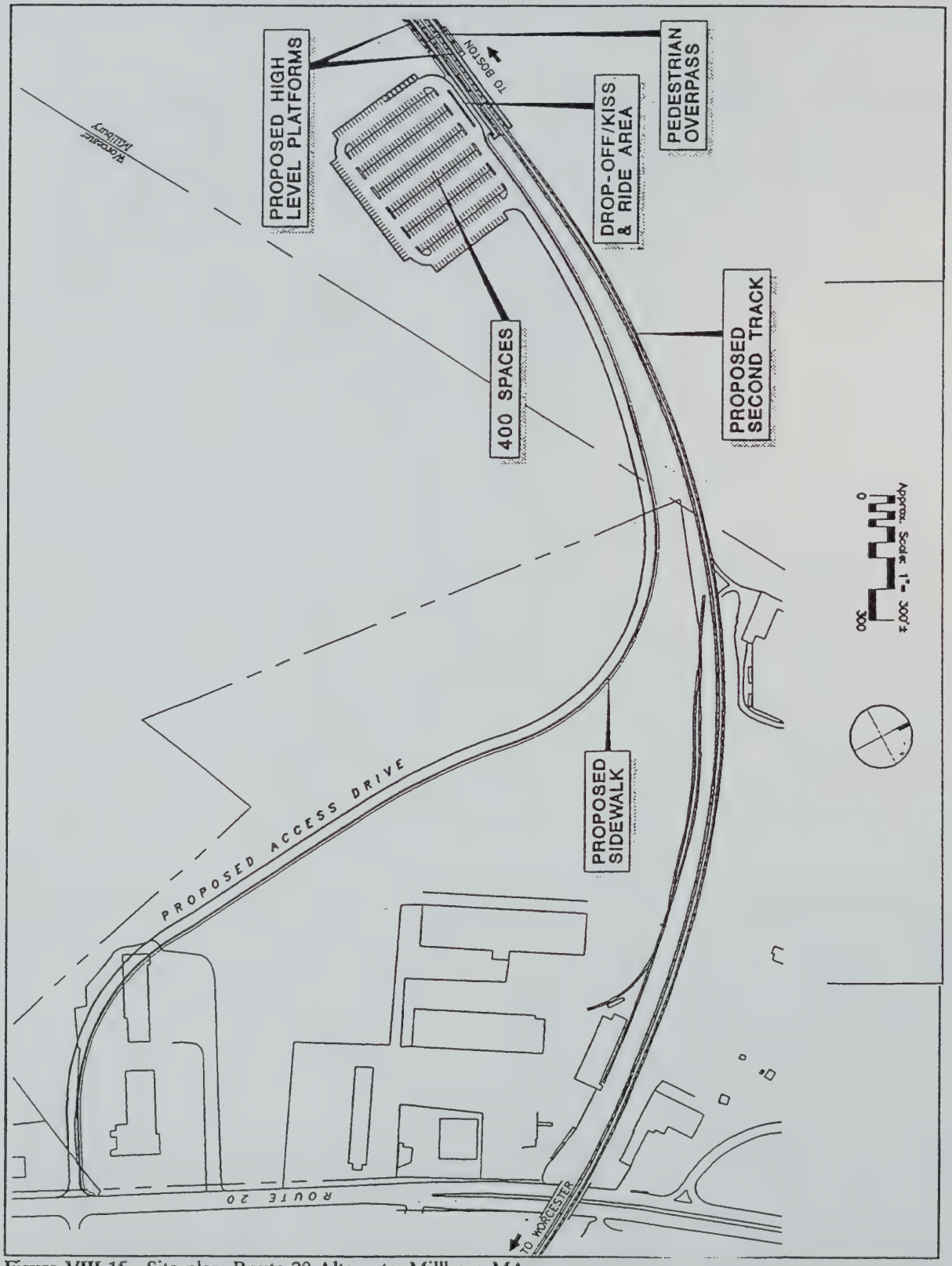


Figure VIII-15 - Site plan, Route 20 Alternate, Millbury, MA.

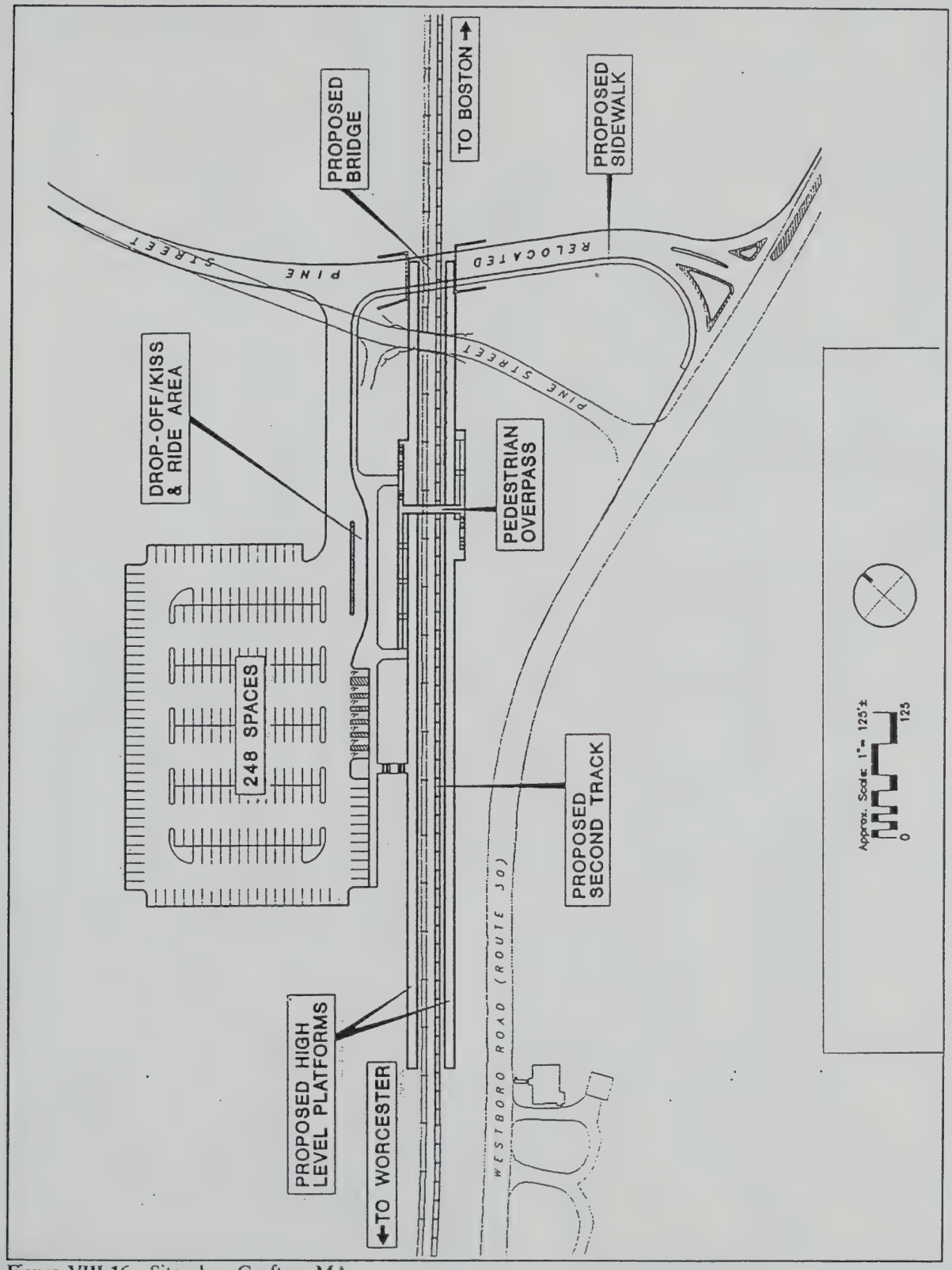


Figure VIII-16 - Site plan, Grafton, MA.

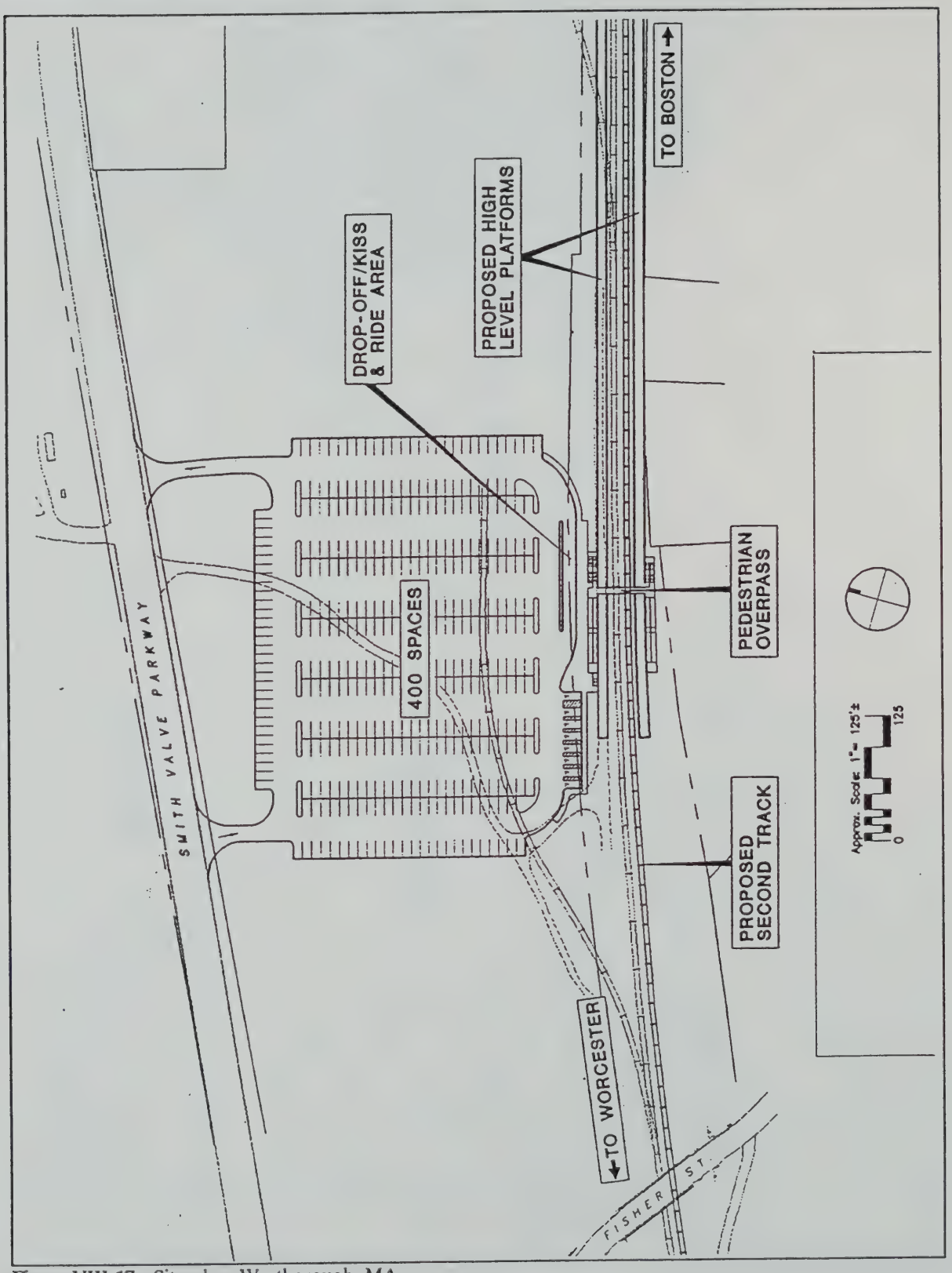


Figure VIII-17 - Site plan, Westborough, MA.

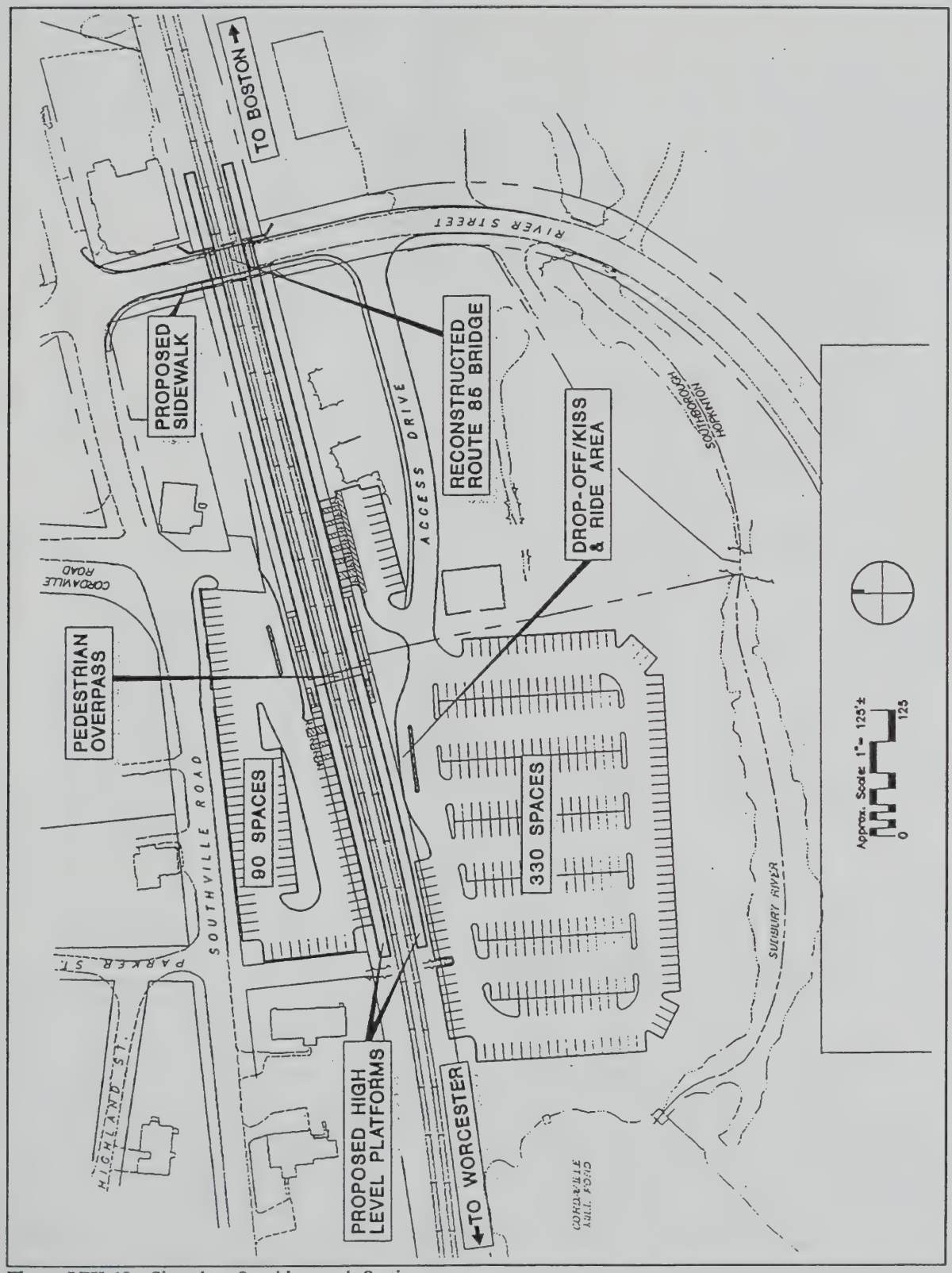


Figure VIII-18 - Site plan, Southborough Station.

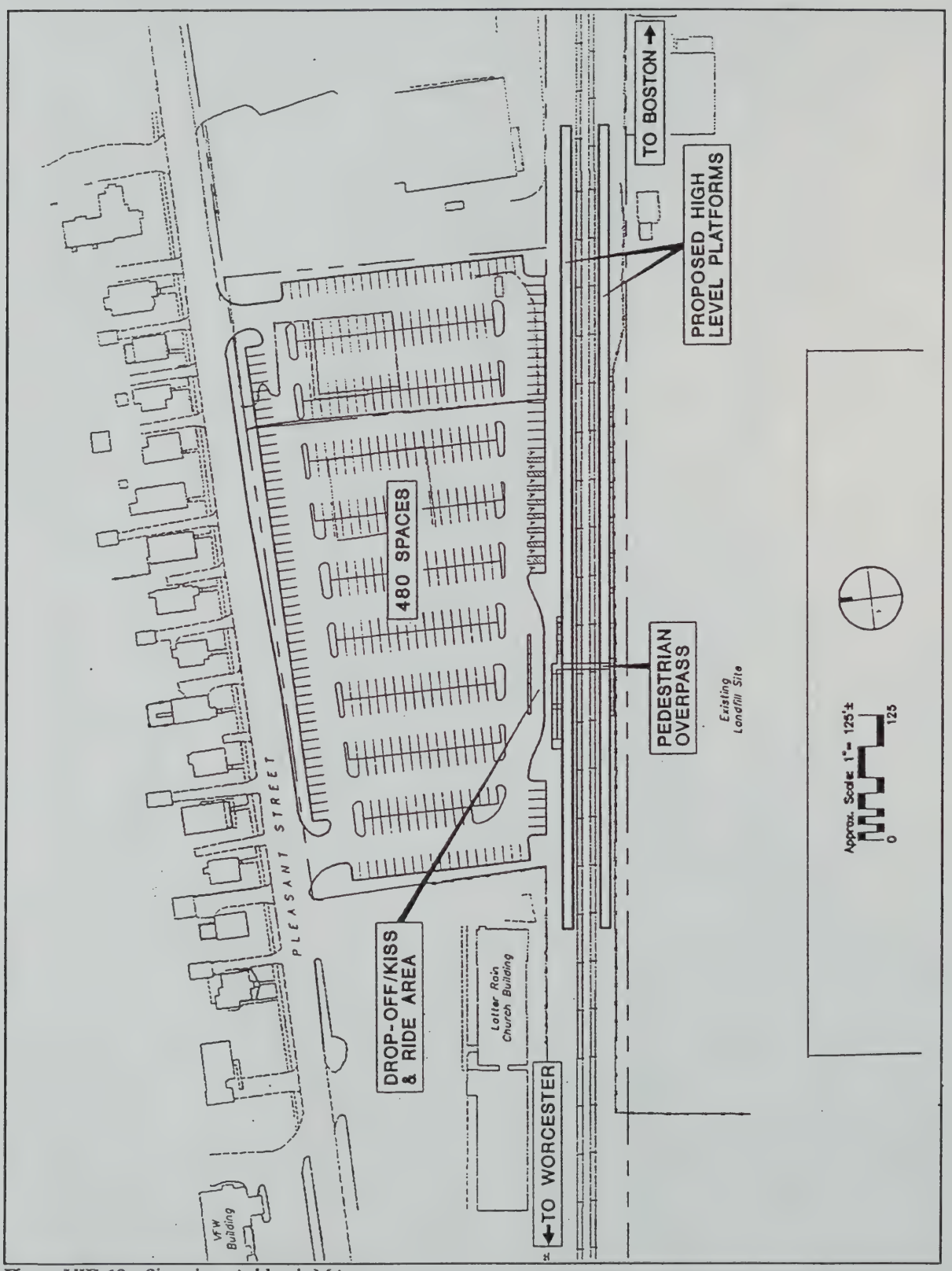


Figure VIII-19 - Site plan, Ashland, MA.

IX. MANAGEMENT RECOMMENDATIONS

The basic goal of the archaeological reconnaissance survey of the WCRE project rail corridor was the assessment of known and expected cultural resources along the rail corridor. The earlier chapters of this report describe the process and results of this study, culminating in the models of archaeological sensitivity. The MBTA can use this information to help make decisions about project design, and the MHC will use the same information to formulate cultural-resource-management decisions with respect to the WCRE project. This final chapter of the reconnaissance report provides the MHC with recommendations for these decisions.

A. Impact Analysis

The WCRE project involves three different kinds of potential impacts to cultural resources.

The first is that which may occur to archaeological sites along the existing rail line. Since the original construction and subsequent maintenance of the rail line, together with the additional building along the rail line, have created a ribbon of disturbance along the entire rail corridor, the WCRE project will impact archaeological sites only when the project construction extends outside the existing limits of disturbance.

The components of the project that may produce these additional disturbances include the following:

- The second track along the 11 miles between Segment 3i and Segment 8b may require a wider ballast bed, and therefore a lateral expansion of the ballast and potentially of drainage facilities, at certain points along the rail corridor. When lateral expansion occurs beyond the limits of existing disturbance, cultural resources may be impacted.

- The chain-link fencing to be placed along certain portions of the rail corridor will probably be set along the edge of the right-of-way and not within the limits of existing disturbance. The rail right-of-way is generally 80 feet in width. Any fencing erected at the edge of the existing disturbance may impact cultural resources.

- The rebuilding of the Pine Street bridge in Grafton (Segments 5j and 6a) and the Route 85 bridge in Southborough (Segments 10g and 11a) will cause disturbance to the original bridge sites and to the new bridge sites, thus potentially impacting cultural resources. The renovation to other bridges and some culverts may also impact cultural resources if the resulting disturbances extend outside the limits of existing disturbances of the rail corridor.

- Construction activity along the rail corridor, including movement of heavy equipment or creation of temporary staging areas, may cause impacts to cultural resources outside the limits of existing disturbance. Construction activities may cause direct impacts, but may also create indirect impacts by accelerating erosion of cut faces in glacial knolls. This problem is most critical in the Cedar Swamp Archaeological District, where prehistoric sites occur at the top of railroad cuts (e.g. in Segment 9i).

Excepting the bridge work, the location of these potential disturbances cannot be identified, pending approval of the final project design.

The second kind of impact is that which will occur to archaeological sites in the five proposed station areas. These impacts will generally occur in areas that the railroad has not previously affected, and will occur on blocks of land rather than at intermittent points along the rail corridor. The station constructions involve the station platforms, parking lots, and access roads, as well as up-grades of the track in the station areas. Since the location of the Millbury and Ashland stations has not been decided, the potential station impacts may involve more than five different pieces of land.

The third kind of impact is that which involves standing architecture, including bridges, dwellings, industrial facilities, railroad facilities, and other historic properties that are potentially significant and potentially eligible for listing in the National or State Register. The impacts to historic resources include the visual impacts of the new stations that might change the setting and feel of historic properties, the taking of buildings for station construction, and the reconstruction or renovation of bridges.

B. Recommendations

The cultural-resource-management recommendations will address separately each of the three kinds of potential impacts, looking first at the rail corridor, then at the stations, and finally at the historic properties.

1. Rail Corridor

Since the location of potential impacts cannot certainly be identified before the final design is established, the recommendations for the rail corridor must be generic. The predictive model established sensitivity ratings for segments of the rail. Since the sensitivity ratings in the model for historic archaeological sites generally mirror those in the model for prehistoric sites, the latter will be used alone. Table 13 presents the survey segments arranged by the three sensitivity ratings. The different sensitivity ratings require different management recommendations.

Table 13 indicates that most of the rail corridor has a low likelihood of containing prehistoric archaeological sites; these segments require no additional archaeological attention.

The segments that received a high sensitivity rating should be subjected to an intensive archaeological survey, the strategy of which should be systematic test pits at 12 m. intervals. However, only those portions of high sensitivity segments that will be subject to construction impacts as defined in the final project design, i.e. the area of direct or indirect impacts that occur outside the limits of existing disturbance, should be tested.

The segments that received a moderate sensitivity rating should also be subjected to an intensive archaeological survey, the strategy of which should be judgmental test pits or systematic test pits at 20 m. intervals, depending on the size of the area to be impacted. Again, only those portions of moderate sensitivity segments should be tested that will be subject to construction impacts as defined in the final project design, i.e. the area of direct or indirect impacts that occur outside the limits of existing disturbance.

TABLE 13: Survey Segments Listed by Prehistoric Sensitivity Rating

	I	II	III
Segment 1			ALL
Segment 2		e-f,h	a-d, g
Segment 3		i	a-h, j-k
Segment 4	e, g	d, m	a-c, f, h-l, n
Segment 5	d-e, g*	b*, f, h, i*, j	a, b*, c, g*, i*
Segment 6	a, b*, f-g	c-d, i	b*, e, h, j
Segment 7	a*, b*		a*, b*, c-i
Segment 8	e-f, h*, i		a-d, g, h*, j-m
Segment 9	e, f*, g, i, k*, l*		a-d, f*, h, j, k*, l*, m-p
Segment 10	a-b, d, f*		c, e, f*, g
Segment 11	c*, d, e*, f, g*, i*	h*	a-b, c*, e*, g*, i*
Segment 12	e-f, g*	b	a, c-d, g*, h-l
Segment 13	f, g*	h*	a-e, g*, h*, i-o

* Denotes segments with different sensitivity ratings on each side of rail corridor, and therefore listed twice

2. *Proposed Stations*

a. Millbury Station -- Route 122

The topographic character of the proposed station area and of the southern 100 m. of the access road confer a high sensitivity rating for these portions of the Millbury Station - Route 122 option. The proposed station area and the southern 100 m. of the station therefore should be subject to an archaeological intensive survey, consisting of systematic test pits at 12 m. intervals, prior to the station construction. The intensive survey should focus on detection of prehistoric sites.

b. Millbury Station -- Route 20

The topographic character of the proposed station area and of the eastern 100 m. of the access road confer a high sensitivity rating for these portions of the Millbury Station - Route 20 option. The proposed station area and the eastern 100 m. of the station therefore should be subject to an archaeological intensive survey, consisting of systematic test pits at 12 m. intervals, prior to the station construction. The intensive survey should focus on detection of prehistoric sites.

c. Grafton Station

The topographic character of the proposed station area confer a high sensitivity rating for the Grafton station. The proposed station area therefore should be subject to an archaeological intensive survey, consisting of systematic test pits at 12 m. intervals, prior to the station construction. This intensive survey should also incorporate in its testing strategy the impact areas resulting from the rebuilding of the Pine Street bridge. The intensive survey should focus on detection of prehistoric sites.

d. Westborough Station

The topographic character of the proposed location for the Westborough station provides a moderate to high sensitivity rating for this area. Moreover, the MHC site files record several prehistoric and Contact period sites between the rail corridor and Hocomonco Pond, and a small amount of chipping debris is reported to have been found in the proposed station area. However, the proposed station area also contains extensive disturbance, and the prehistoric chipped stone may represent a disturbed or redeposited site, not necessarily in the station area. These factors suggest that the extent and depth of existing disturbance in the station area should be assessed as the first step of an intensive archaeological survey. Should the disturbance prove to be localized, the intensive survey should then systematically test the appropriate sections of the proposed station area.

e. Southborough Station

The proposed Southborough station will take land previously occupied by the Cordaville mill village. According to a bridge and site plan (Fig. IV-30), the proposed construction activities will be limited largely to an area west of the extant architecture of the Cordaville mill. Archaeological remains of the mill itself may exist in the former area as cellars and associated features beneath 3-4 m. of fill. The current design schedules the station parking lot to be placed over this fill, thereby sealing and further protecting this portion of the site. A pedestrian overpass, ramps, and a low level platform on the south side of the tracks may impact the foundations of the former train depot.

Major portions of the mill architecture still survive, including stone foundations, raceways, stone-arch bridges, a millpond and a dam, and the bed for a railroad spur line. Documentary evidence for the mill is excellent, and includes an auction catalogue of the Sanford Factory (Freeman 1928), a panoramic view of both Southville and Cordaville villages in the late nineteenth century (O.H. Bailey 1887), and detailed maps of both villages (Figs. IV-21 and IV-22). Furthermore, recent work on the industrial village of Lowell (Beaudry and Mrozowski 1987a, 1987b, 1989) can illuminate interpretations of Cordaville, by providing comparative information on nineteenth century Massachusetts mill villages.

These considerations suggest that the Cordaville mill site need not be subject to archaeological testing before the WCRE construction. However, the site's interpretive potential is considerable (see Carolan and Roberts 1993).

Timelines recommends that a program of detailed mapping, architectural planning, and documentary research be undertaken on the Cordaville mill and mill village. This program would have two basic goals. The first goal

would be identification of outlying buildings and potential features of the mill village that the WCRE project might impact. A final decision on the need for archaeological testing should wait on the results of this program.

The second goal of the research program would be providing the MBTA with information to use in a public education program. The Cordaville mill site could be used advantageously to illustrate several historical themes of both local and regional interest. These potential interpretative themes include:

- the specific history of the Cordaville textile mills and workers' village, and the biographies of Milton and Cordelia Sanford;
- textile-mill technology;
- the impact of the railroad on the industrialization and social fabric of Massachusetts towns;
- the role of the railroad and the success of the Union Army.

The MBTA public-education program might consist of interpretative displays at the new station, and/or a self-guided tour of the mill site using leaflets and interpretative signs.

f. Ashland

The proposed Ashland station is to be placed in a topographic setting that expresses a high sensitivity to archaeological site location. Moreover, the MHC prehistoric site files refer to a known site in or near the proposed station, and historic period sites are also likely to be present. However, the proposed station area also contains extensive apparent disturbance. These factors suggest that the extent and depth of existing disturbance in the station area should be assessed as the first step in an intensive archaeological survey. Should the disturbance prove to be localized and/or shallow, the intensive survey should then systematically test the appropriate sections of the proposed station area.

3. *Standing Historic Architecture*

It is recommended that a complete architectural survey be performed. This would entail field work, research, and completion of Massachusetts Historical Commission inventory forms. It is anticipated that while the majority of resources will need Form B Individual Building forms and/or Form F Structure forms, some sections of the corridor, such as Worcester, will be inventoried on Form A Area forms, because of concentrations of industrial structures.

Mitigation measures, including documentation, will be designed for structures that will suffer construction impacts significantly altering the original fabric or be demolished for station construction.

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SECTION 5.0

DRAINAGE, WETLANDS, AND WILDLIFE

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APPENDIX

5.0 DRAINAGE, WETLANDS, AND WILDLIFE

5.1 Project Objective

The objective of this drainage analysis is to demonstrate a zero net increase in the peak flow rates for a 10 year and 100 year design storm. This will serve to diminish any chance of flooding impacts resulting from proposed construction alterations for the station sties. By maintaining or reducing the pre-construction flow quantities the integrity of the existing runoff characteristics and wetland systems will be preserved.

5.2 Analysis Methodology

The Drainage Methodology applied in this analysis is a compilation of several procedures. They are broken into two major parts. The first is a method of quantifying the runoff from a given area based on site specific conditions. The second portion involves a hydraulic and hydrologic analysis to ensure that no increased flood potential will occur as a result of the proposed project.

Runoff quantities have been calculated utilizing the Technical Release No. 55 (TR-55) procedure. The necessary parameters for this calculation include mapping of the watershed areas to determine limits of overland flow which will affect a given design location. Topographic mapping provides a reasonable estimate of these tributary areas. Also necessary is information about flow paths, surface type, ground cover and soil types for the watershed area.

Flow paths and times of concentration may also be determined utilizing topographic maps. The time of concentration is the maximum travel time a water drop takes to traverse the water shed area. As rain hits a remote area on the site, runoff generates

and is directed towards the design point. A site inspection is necessary to determine the surface type and ground cover. This ranges from wooded areas capturing a large portion of rain fall through evapotranspiration and vegetative uptake, to paved parking areas where nearly 100% of the rain fall becomes run off.

Soils are normally classified by the Soil Conservation Service. These soil types are broken into four hydrologic soil groups (A-D). These areas range from Area "A" which allows a great deal of infiltration to Area "D" allowing very little infiltration.

The TR-55 program uses this information along with region specific rainfall parameters to estimate peak rates of runoff. The terminology used in the calculations include Curve Number (CN) and Time of Concentration (TOC). The CN relates the soil types and ground cover characteristics to weight this factor related to the percent of rain fall that actually "runs off" the surface. TOC is used to choose the storm conditions that determine the severity of the design event.

The design storm for this procedure is based on a 24 hour rain fall. The national weather service monitors storms and has regionally quantified storm intensities using the 24 hour scale. Peak rates of run off are developed from this "Hydrograph" method which is a convenient way to compare most storms.

Drainage systems are designed to capture the anticipated runoff quantities and implement mitigation effort to reduce peak flow rates to not exceed the preconstruction conditions. These systems typically involve a detention basin. A detention basin is a very effective means of controlling stormwater runoff. They function by providing a volume necessary to allow temporary storage of the stormwater before releasing it at a controlled rate.

The basins include an outflow control structure which can be utilized as a hydraulic flow regulating device. As head builds within the basin, the effects on the outflow device increases. A relationship develops between the head water in the basin, the storage volumes provided for the varying elevations and inflow and outflow rates for time specific conditions. This is known as a stage-storage-discharge relationship.

The *Hydrocad* stormwater modelling procedure utilizes this concept. Hydrocad models a design storm hydrograph based on a TR-20 method, then routs the storm through the basin (or pond) to generate the stage-storage-discharge results.

The basins are typically designed to accommodate the 10 year and 100 year storm events. The basins will have side slopes graded no steeper than 3 horizontal to 1 vertical (3:1). The slopes and bottom of the basin will be loamed and seeded to provide additional stormwater Best Management Practice (BMP) advantages. The

grassed surfaces not only resist erosion and are aesthetically preferred, but also increase the contact time within the basins and allow for filtration of unwanted nutrient contaminants.

The outflow control structures have been modelled either as rectangular weirs, or culverts depending on the needs of particular sites. In either case, the hydraulic relationship is obtained to provide the peak flow reduction to acceptable levels.

Additional water quality BMP's will be provided for site specific needs as they become apparent during subsequent meetings with local conservation commissions and various regulatory agencies. These BMP's may include sedimentation basins, grass lined swales, stilling pools, wet ponds, etc. The need for individual water quality purification will trigger appropriate mitigation elements in the following design submissions.

5.3 Station Site Hydrological Analysis

5.3.A Millbury Station - Route 122 Alternative (South)

Objective

To provide a zero net increase to the peak flow rate as storm water enters the existing wetland system south of the station site.

Assumptions and Methodologies

The design storm has been modelled as a Type III storm in Worcester County. This results with a 4.5 in. and 6.5 in. 24 hour rainfall for the 10 year and 100 year design storm, respectively. The site drainage area is assumed to be grass land in the existing condition.

Summary of Peak Flows

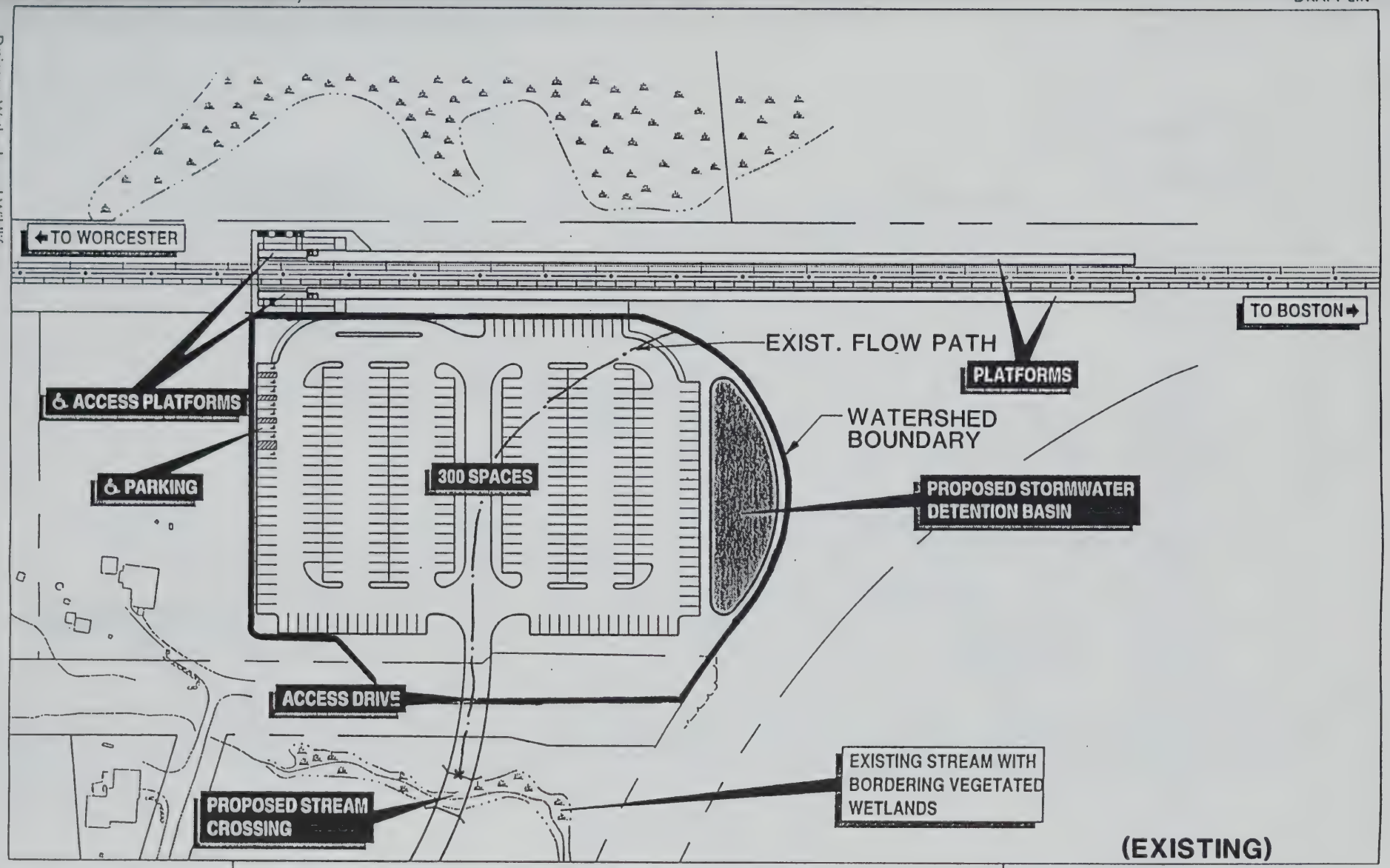
The following Table demonstrates the existing and proposed peak runoff quantities for a 10 year and 100 year design storm.

Table 5.3-1 Peak Runoff Rates - Millbury Station - Route 122 Alternative (South)

Storm Event	Existing Conditions	Proposed Conditions
10 Year	5.2 cfs	4.3 cfs
100 Year	10.4 cfs	5.3 cfs

Conclusions

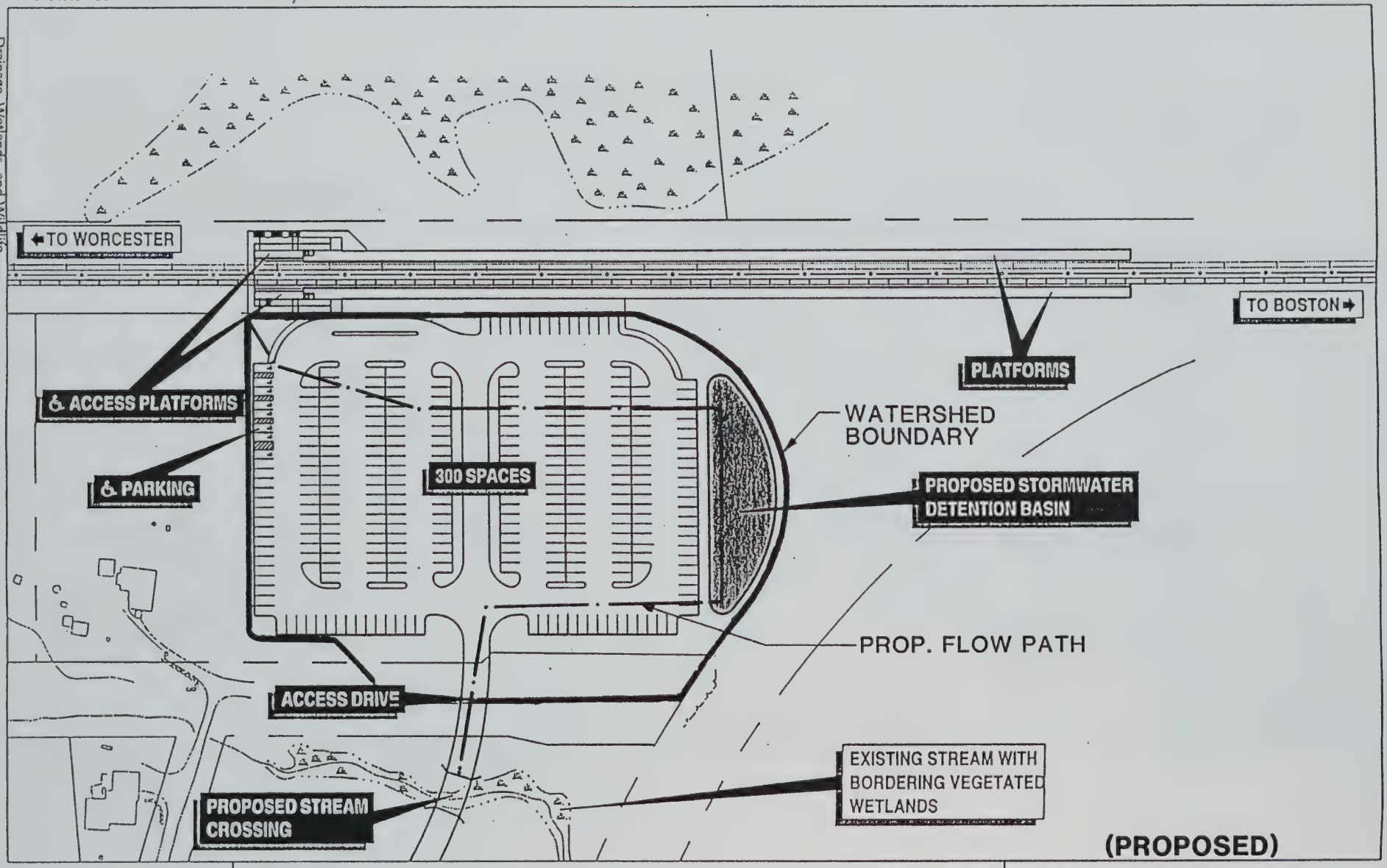
The detention basin has been designed to adequately accommodate the increased runoff generated from proposed construction. The existing condition peak flow rate has not been exceeded. No flooding impacts will result from construction of this station site.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

WATERSHED PLAN
ROUTE 122 ALTERNATIVE
MILLBURY, MA
FIGURE 5.3.A-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

(PROPOSED)

WATERSHED PLAN
ROUTE 122 ALTERNATIVE
MILLBURY, MA
FIGURE 5.3.A-2

Table 5.3-2 Watershed Data - Existing Conditions Millbury Station - Route 122 Alternative (South)
A = 3.5 AC
Open Space (Grassland/Range)
HSG: (Hydrologic Soil Group) "B"
L_1 = 50′, S=3% (sheet flow), F
L_2 = 480′, S=1.5% (shallow concentrated), U

From TR-55	CN = 69	
	TOC = .19 hrs = 11 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	1.6 in	3.1 in
Unit Peak Discharge (cfs/acre/in)	.837	.873
Peak Discharge	5 cfs (4.69)	9 cfs (9.47)

Table 5.3-3 Watershed Data - Proposed Conditions Millbury Station - Route 122 Alternative (South)
A = 3.5 AC
2.6 AC Pavement, .9 AC Open Space (Grassland/Range)
HSG: "B"
L_1 = 50′, S=3% (sheet flow), F
L_2 = 140′, S=2% (shallow concentrated), P
L_3 = 460′, (open channel) <V=3 fps assumed>
L_4 = 370′, (open channel) <V=3 fps assumed>

From TR-55	CN = 91	
	TOC = .17 hrs = 10 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	3.5 in	5.4 in
Unit Peak Discharge (cfs/acre/in)	.922	.922
Peak Discharge	11 cfs (11.29)	18 cfs (17.59)

Detention Pond Parameters

This detention basin in designed with three horizontal to one vertical (3:1) sideslopes. The outlet device will be a 12" diameter reinforced concrete pipe. It has been modelled to act as a culvert with no tail water effects. The discharge will be into an existing stream. Outlets are to include a rip rap apron to slow velocities and dissipate hydraulic energies.

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-SOUTH User: RLD Date: 06-28-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	-	3.5(69)	-	-
Total Area (by Hydrologic Soil Group)			3.5		

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.5 Acres WEIGHTED CURVE NUMBER:69*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-SOUTH User: RLD Date: 06-28-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.03	F					0.120
Shallow Concent'd		480	.015	U					0.067
					Time of Concentration =				0.19*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-SOUTH User: RLD Date: 06-28-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		-	2.6(98)	-	-
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	-	.9(69)	-	-
Total Area (by Hydrologic Soil Group)			3.5		

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.5 Acres WEIGHTED CURVE NUMBER:91*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-SOUTH User: RLD Date: 06-28-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.03	E					0.078
Shallow Concent'd		140	.02	P					0.014
Open Channel		460						3	0.043
Open Channel		370						3	0.034
								Time of Concentration =	0.17*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

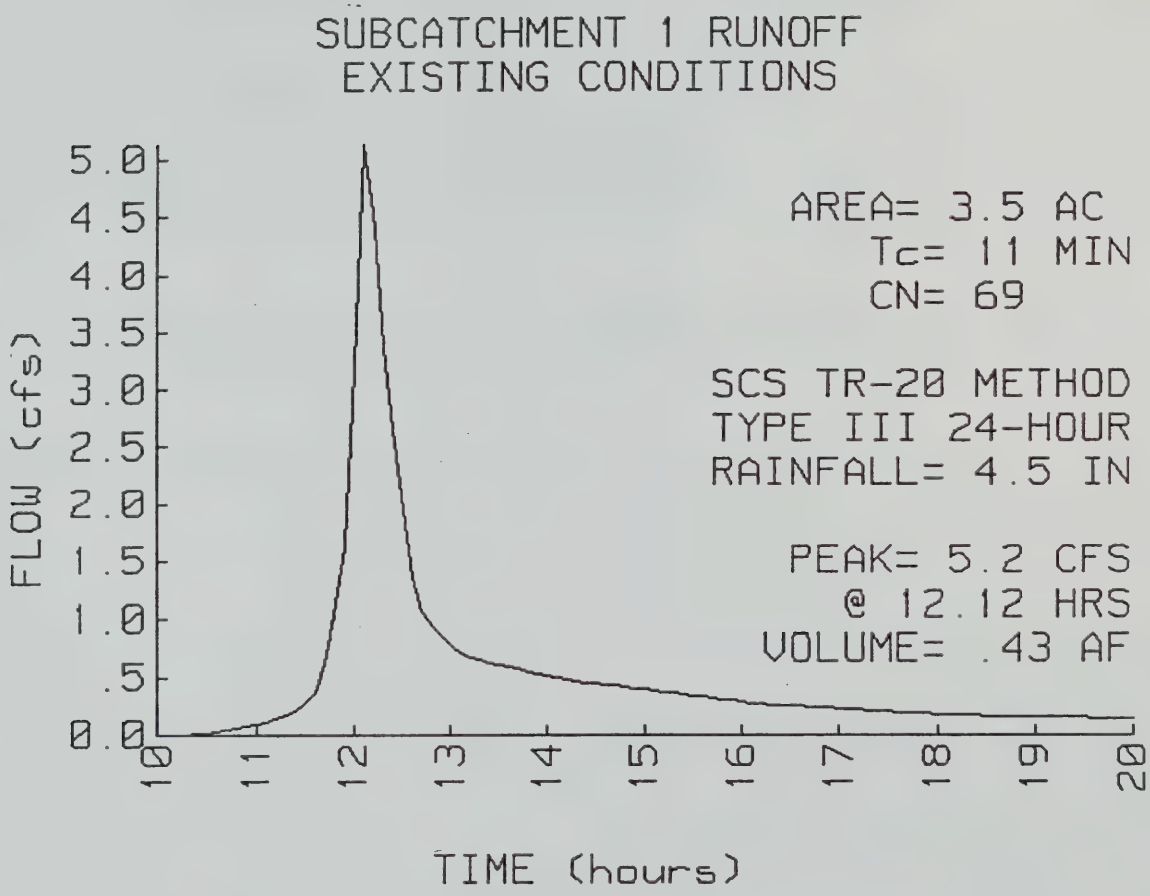
* - Generated for use by GRAPHIC method

SUBCATCHMENT 1 **EXISTING CONDITIONS** 10 YEAR STORM

ACRES	CN	
3.50	69	OPEN SPACE - GRASSLAND/RANGE

AREA= 3.50 AC Tc= 11 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 5.2 CFS @ 12.12 HRS
VOLUME= .43 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 5.2 CFS @ 12.12 HOURS

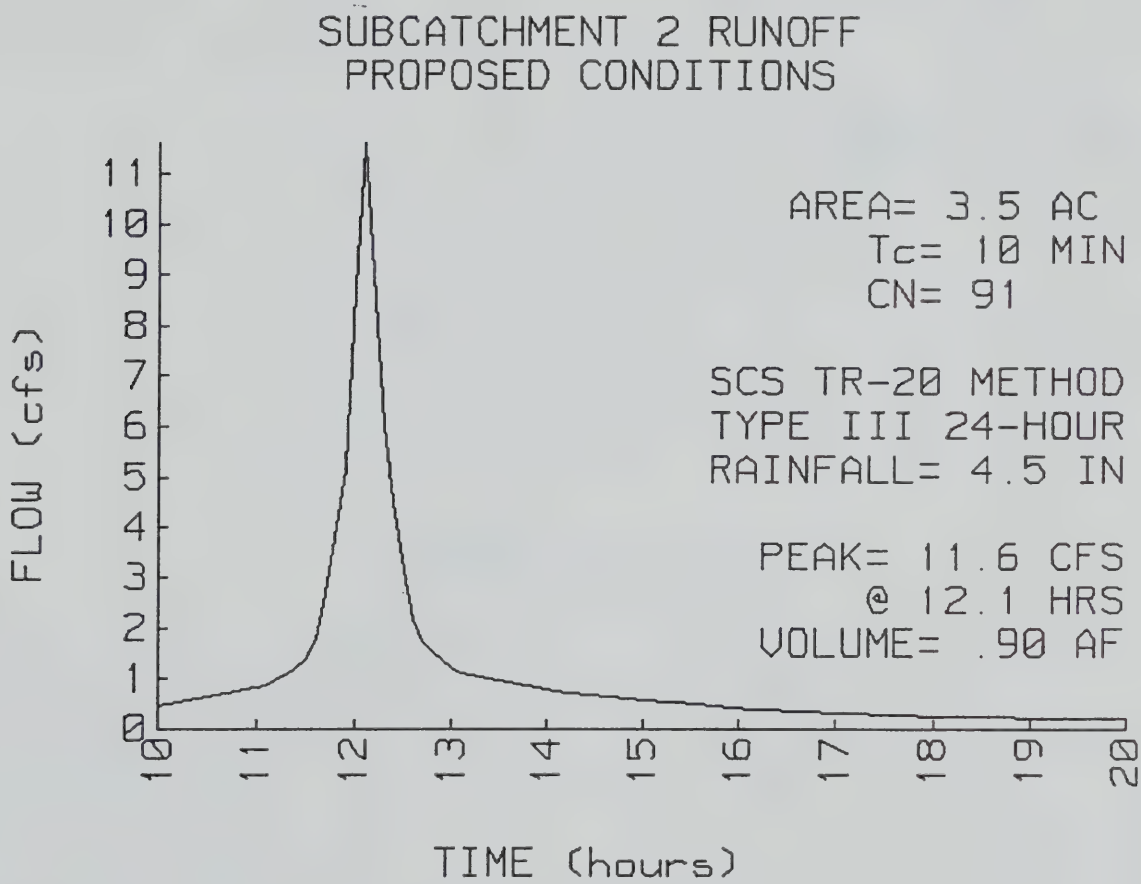
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1
11.00	.1	.1	.1	.2	.2	.3	.4	.6	1.0	1.6
12.00	3.2	5.1	4.4	3.4	2.6	1.9	1.4	1.1	.9	.9
13.00	.8	.7	.7	.6	.6	.6	.6	.6	.5	.5
14.00	.5	.5	.5	.5	.5	.4	.4	.4	.4	.4
15.00	.4	.4	.4	.4	.3	.3	.3	.3	.3	.3
16.00	.3	.3	.3	.3	.3	.2	.2	.2	.2	.2
17.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.1	.1	.1	.1	.1
20.00	.1									

SUBCATCHMENT 2 **PROPOSED CONDITIONS** 10 YEAR STORM

ACRES	CN	
2.60	98	PAVED DRIVE AND LOT
.90	69	OPEN SPACE-GRASSLAND/RANGE
3.50	91	

AREA= 3.50 AC Tc= 10 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 11.6 CFS @ 12.10 HRS
VOLUME= .90 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 11.6 CFS @ 12.10 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.5	.5	.5	.6	.6	.6	.7	.7	.7	.8
11.00	.8	.9	1.0	1.1	1.2	1.4	1.8	2.7	3.8	5.2
12.00	8.7	11.6	8.5	6.0	4.5	3.2	2.2	1.7	1.5	1.4
13.00	1.2	1.1	1.1	1.0	1.0	1.0	.9	.9	.8	.8
14.00	.8	.7	.7	.7	.7	.7	.7	.6	.6	.6
15.00	.6	.6	.6	.5	.5	.5	.5	.5	.4	.4
16.00	.4	.4	.4	.4	.4	.4	.4	.4	.3	.3
17.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
18.00	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

POND 2 **DETENTION BASIN** 10 YEAR STORM

STARTING ELEV= 384.0 FT
FLOOD ELEV= 388.0 FT

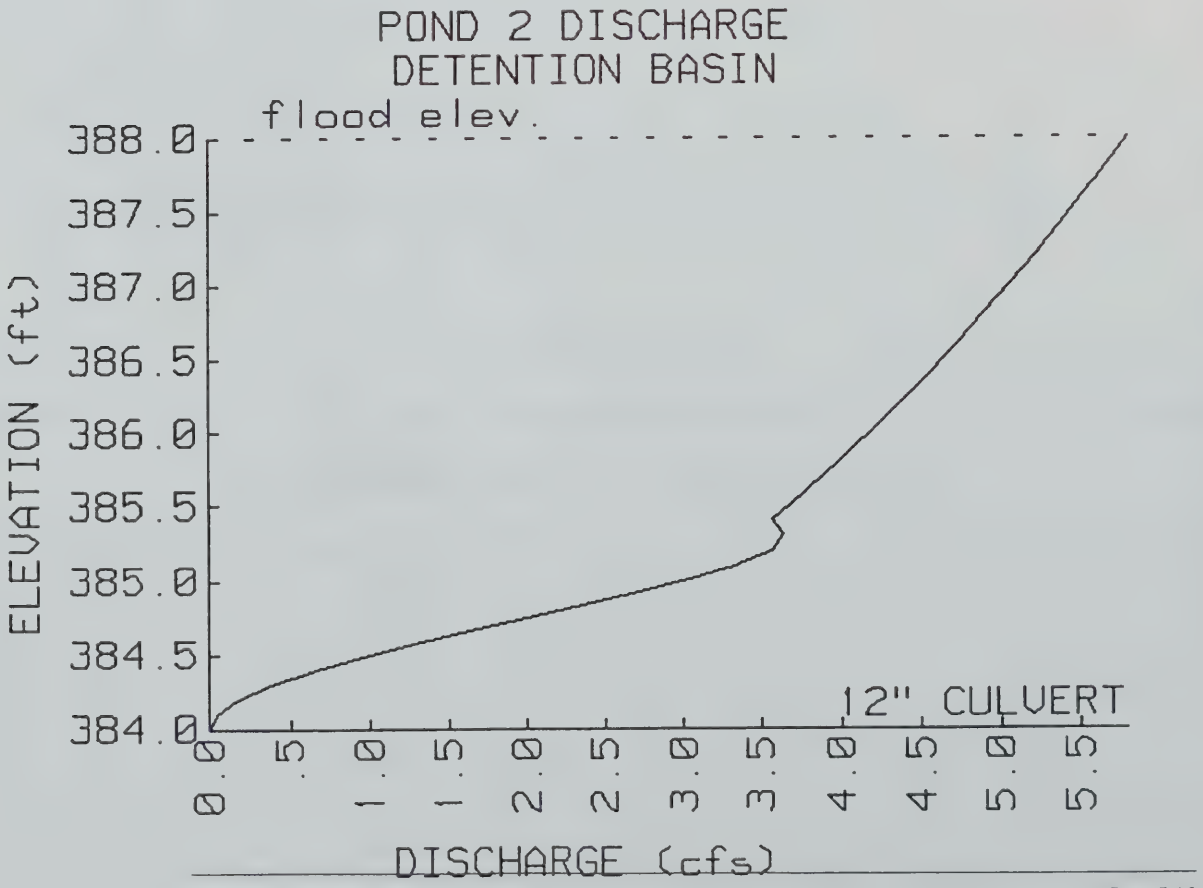
ELEVATION (FT)	CUM.STOR (AF)
384.0	0.00
385.0	.09
386.0	.23
387.0	.37
388.0	.56

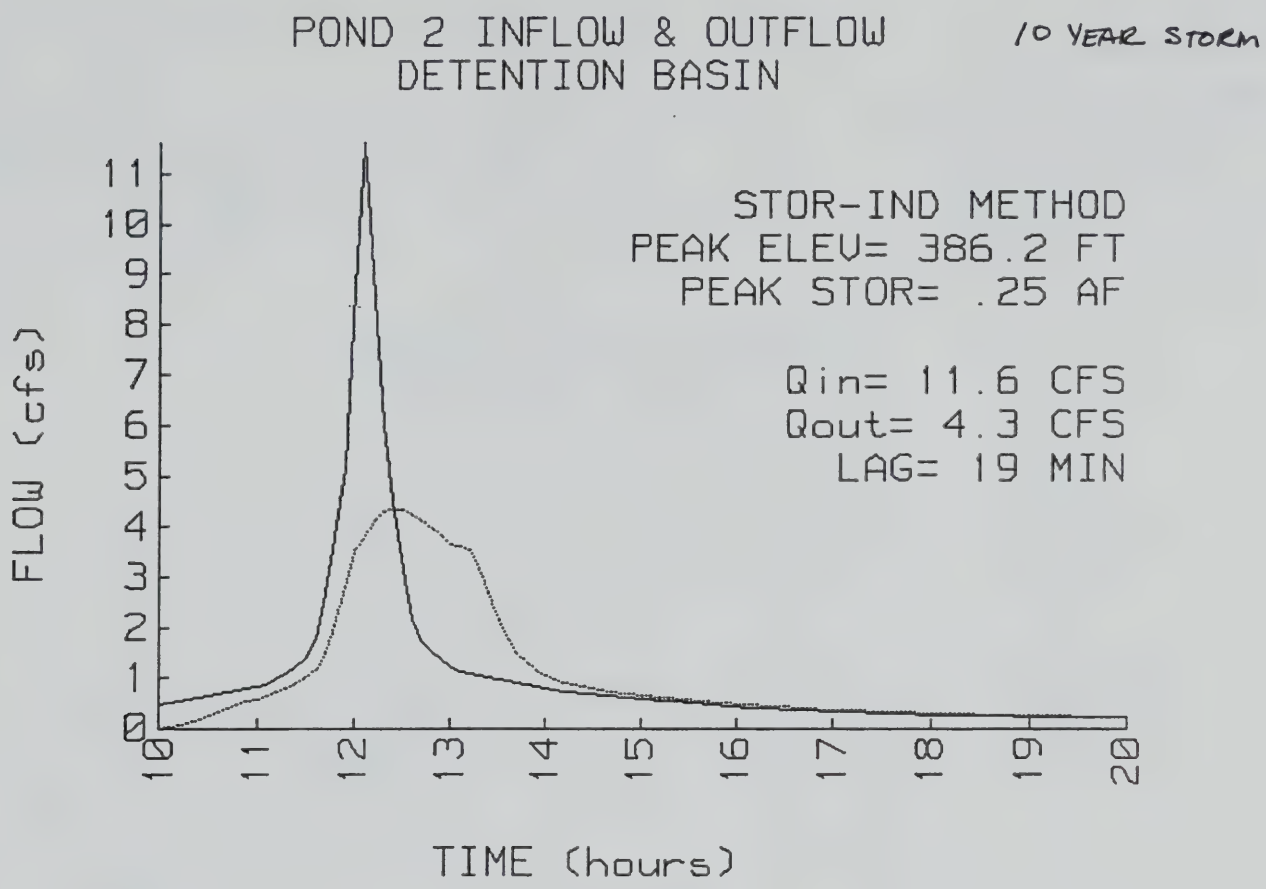
STOR-IND METHOD
PEAK ELEVATION= 386.2 FT
PEAK STORAGE = .25 AF
Qin = 11.6 CFS @ 12.10 HRS
Qout= 4.3 CFS @ 12.42 HRS
ATTEN= 63 % LAG= 19.0 MIN
IN/OUT= .90 / .88 AF

INVERT (FT)	OUTLET DEVICES
384.0	**12" CULVERT** n=.013 L=120' S=.01'/' Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
384.0	0.0	0.0	.2	.4	.7	1.0	1.4	1.8	2.2	2.6
385.0	3.0	3.3	3.6	3.6	3.6	3.7	3.8	3.9	4.0	4.1
386.0	4.2	4.3	4.4	4.5	4.6	4.6	4.7	4.8	4.9	5.0
387.0	5.0	5.1	5.2	5.3	5.4	5.4	5.5	5.6	5.6	5.7
388.0	5.8									





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= 4.3 CFS @ 12.42 HOURS

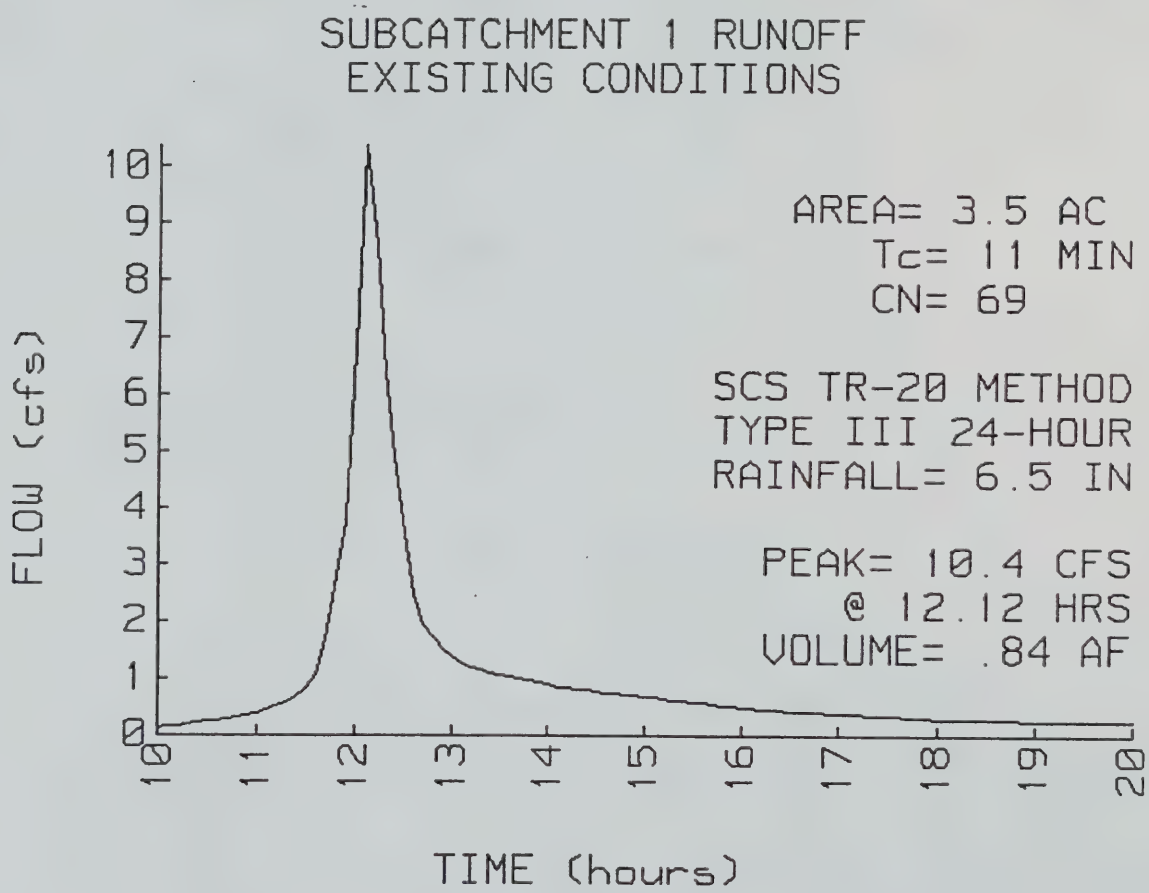
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	.1	.1	.2	.2	.3	.4	.4	.5
11.00	.6	.6	.7	.8	.9	1.0	1.2	1.5	2.0	2.8
12.00	3.5	3.8	4.1	4.3	4.3	4.3	4.2	4.1	4.0	3.8
13.00	3.7	3.6	3.6	3.2	2.7	2.1	1.7	1.5	1.3	1.2
14.00	1.0	1.0	.9	.9	.8	.8	.7	.7	.7	.7
15.00	.7	.6	.6	.6	.6	.6	.5	.5	.5	.5
16.00	.5	.5	.4	.4	.4	.4	.4	.4	.4	.4
17.00	.4	.4	.4	.3	.3	.3	.3	.3	.3	.3
18.00	.3	.3	.3	.3	.3	.3	.3	.3	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

SUBCATCHMENT 1 **EXISTING CONDITIONS** 100 YEAR STORM

ACRES	CN	
3.50	69	OPEN SPACE - GRASSLAND/RANGE

AREA= 3.50 AC Tc= 11 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 10.4 CFS @ 12.12 HRS
VOLUME= .84 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 10.4 CFS @ 12.12 HOURS

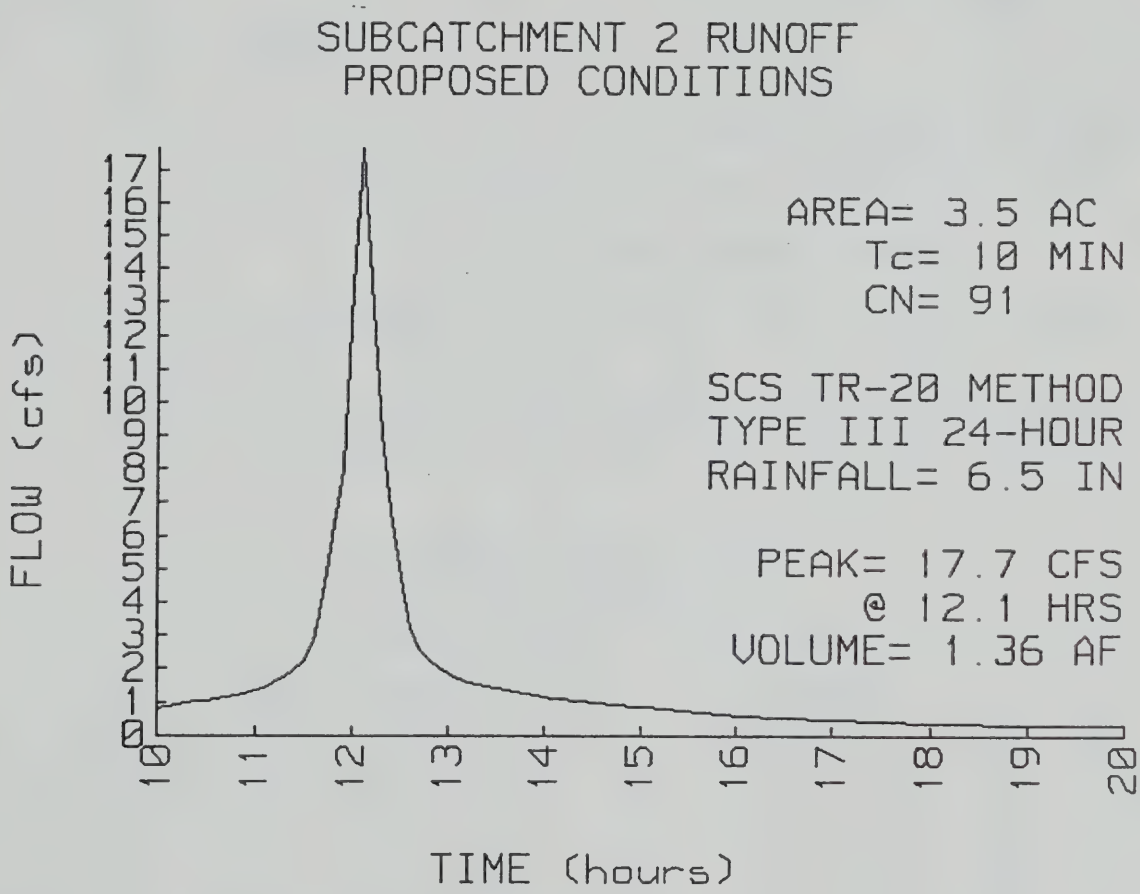
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.1	.1	.2	.2	.2	.2	.3	.3	.3	.4
11.00	.4	.4	.5	.6	.7	.8	1.1	1.7	2.6	3.8
12.00	6.8	10.4	8.6	6.4	4.9	3.5	2.5	1.9	1.7	1.5
13.00	1.4	1.3	1.2	1.1	1.1	1.1	1.0	1.0	1.0	.9
14.00	.9	.8	.8	.8	.8	.8	.7	.7	.7	.7
15.00	.7	.7	.6	.6	.6	.6	.6	.5	.5	.5
16.00	.5	.5	.5	.4	.4	.4	.4	.4	.4	.4
17.00	.4	.4	.4	.4	.3	.3	.3	.3	.3	.3
18.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.2	.2	.2	.2
20.00	.2									

SUBCATCHMENT 2 **PROPOSED CONDITIONS** 100 YEAR STORM

ACRES	CN	
2.60	98	PAVED DRIVE AND LOT
.90	69	OPEN SPACE-GRASSLAND/RANGE
3.50	91	

AREA= 3.50 AC Tc= 10 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 17.7 CFS @ 12.10 HRS
VOLUME= 1.36 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 17.7 CFS @ 12.10 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.8	.9	.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3
11.00	1.3	1.4	1.6	1.8	2.0	2.2	2.8	4.2	6.0	8.0
12.00	13.4	17.6	12.8	9.1	6.7	4.7	3.2	2.6	2.3	2.0
13.00	1.8	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
14.00	1.2	1.1	1.1	1.0	1.0	1.0	1.0	.9	.9	.9
15.00	.9	.8	.8	.8	.8	.7	.7	.7	.7	.6
16.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.5
17.00	.5	.5	.5	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.4	.4	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

POND 2 **DETENTION BASIN** 100 YEAR STORM

STARTING ELEV= 384.0 FT
FLOOD ELEV= 388.0 FT

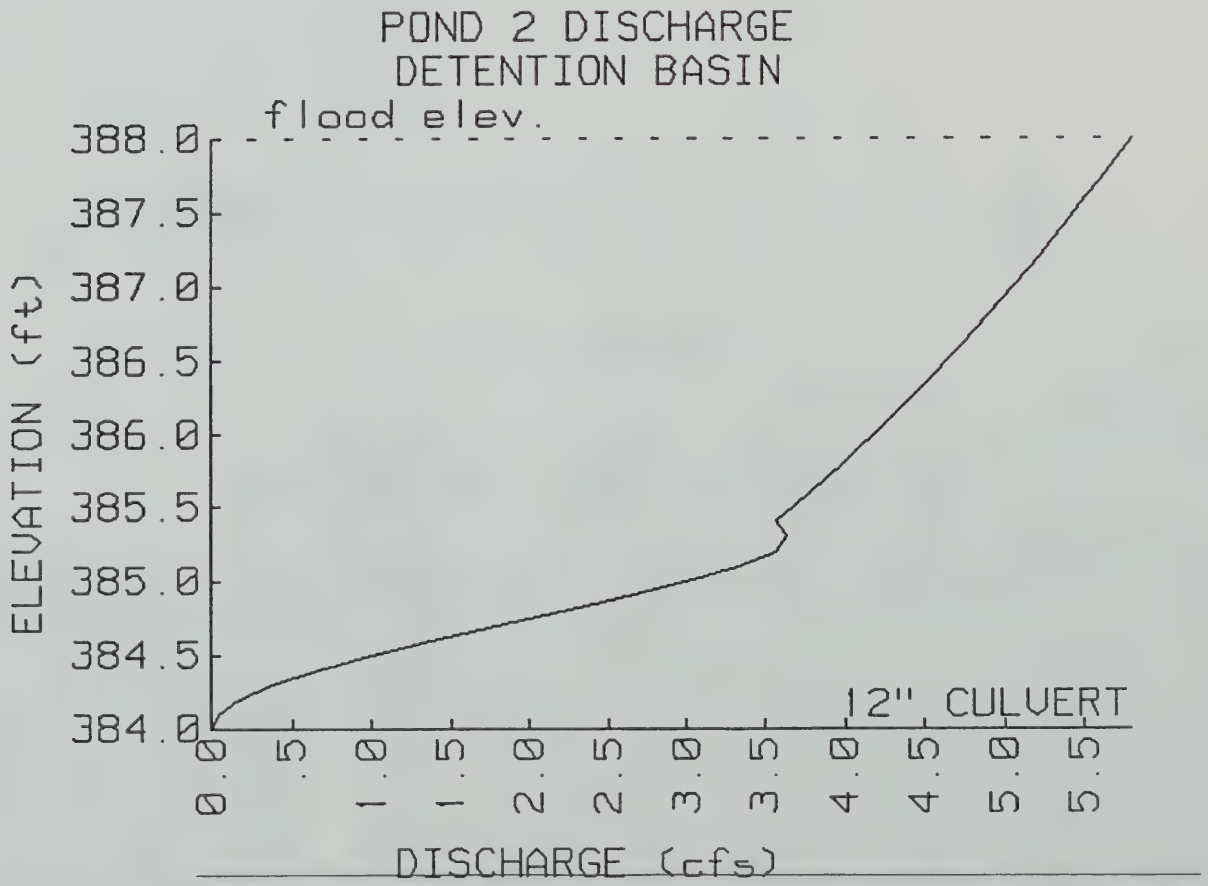
ELEVATION (FT)	CUM.STOR (AF)
384.0	0.00
385.0	.09
386.0	.23
387.0	.37
388.0	.56

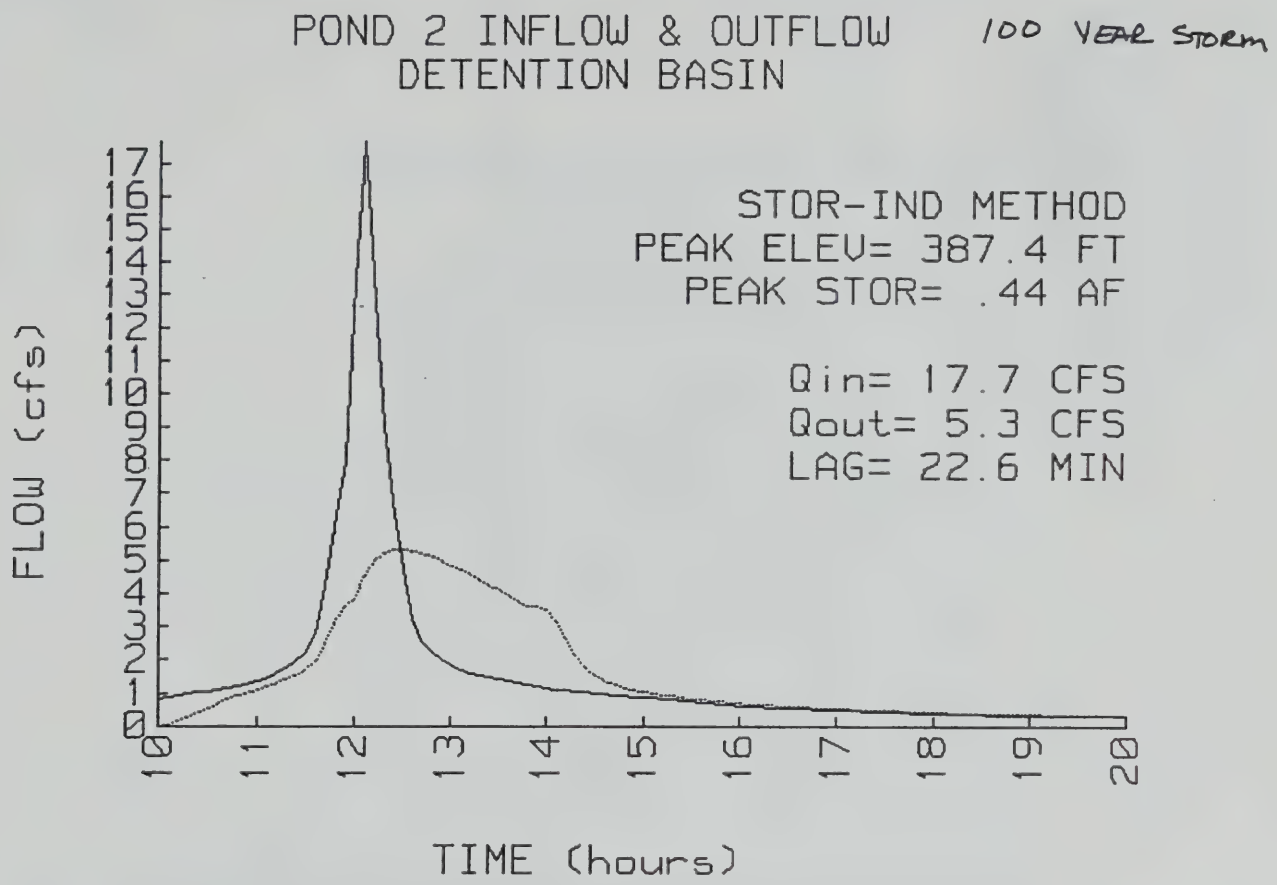
STOR-IND METHOD
PEAK ELEVATION= 387.4 FT
PEAK STORAGE = .44 AF
Qin = 17.7 CFS @ 12.10 HRS
Qout= 5.3 CFS @ 12.47 HRS
ATTEN= 70 % LAG= 22.6 MIN
IN/OUT= 1.36 / 1.34 AF

INVERT (FT)	OUTLET DEVICES
384.0	**12" CULVERT**
	n=.013 L=120' S=.01'/' Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
384.0	0.0	0.0	.2	.4	.7	1.0	1.4	1.8	2.2	2.6
385.0	3.0	3.3	3.6	3.6	3.6	3.7	3.8	3.9	4.0	4.1
386.0	4.2	4.3	4.4	4.5	4.6	4.6	4.7	4.8	4.9	5.0
387.0	5.0	5.1	5.2	5.3	5.4	5.4	5.5	5.6	5.6	5.7
388.0	5.8									





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= 5.3 CFS @ 12.47 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	.1	.1	.3	.4	.5	.7	.8	.9	1.0
11.00	1.1	1.2	1.3	1.4	1.5	1.7	2.0	2.5	3.1	3.6
12.00	3.9	4.5	5.0	5.2	5.3	5.3	5.3	5.2	5.1	5.0
13.00	4.9	4.7	4.6	4.4	4.2	4.1	3.9	3.8	3.6	3.6
14.00	3.5	3.1	2.6	2.1	1.8	1.5	1.4	1.2	1.1	1.1
15.00	1.0	1.0	.9	.9	.9	.8	.8	.8	.7	.7
16.00	.7	.7	.6	.6	.6	.6	.6	.6	.6	.5
17.00	.5	.5	.5	.5	.5	.5	.5	.4	.4	.4
18.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
19.00	.4	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

5.3.B Millbury Station - Route 20 Alternative (North)

Objective

To provide a zero net increase to the peak flow rate as storm water enters the existing wetland system adjacent to the station site.

Assumptions and Methodologies

The design storm has been modelled as a Type III storm in Worcester County. This results with a 4.5 in. and 6.5 in. 24 hour rainfall for the 10 year and 100 year design storm, respectively. The site drainage area is assumed to be wooded in the existing condition. A portion of the access road may be drained into a separate wetland system. Peak flows will be mitigated for the access remainder of the road in subsequent design submissions.

Summary of Peak Flows

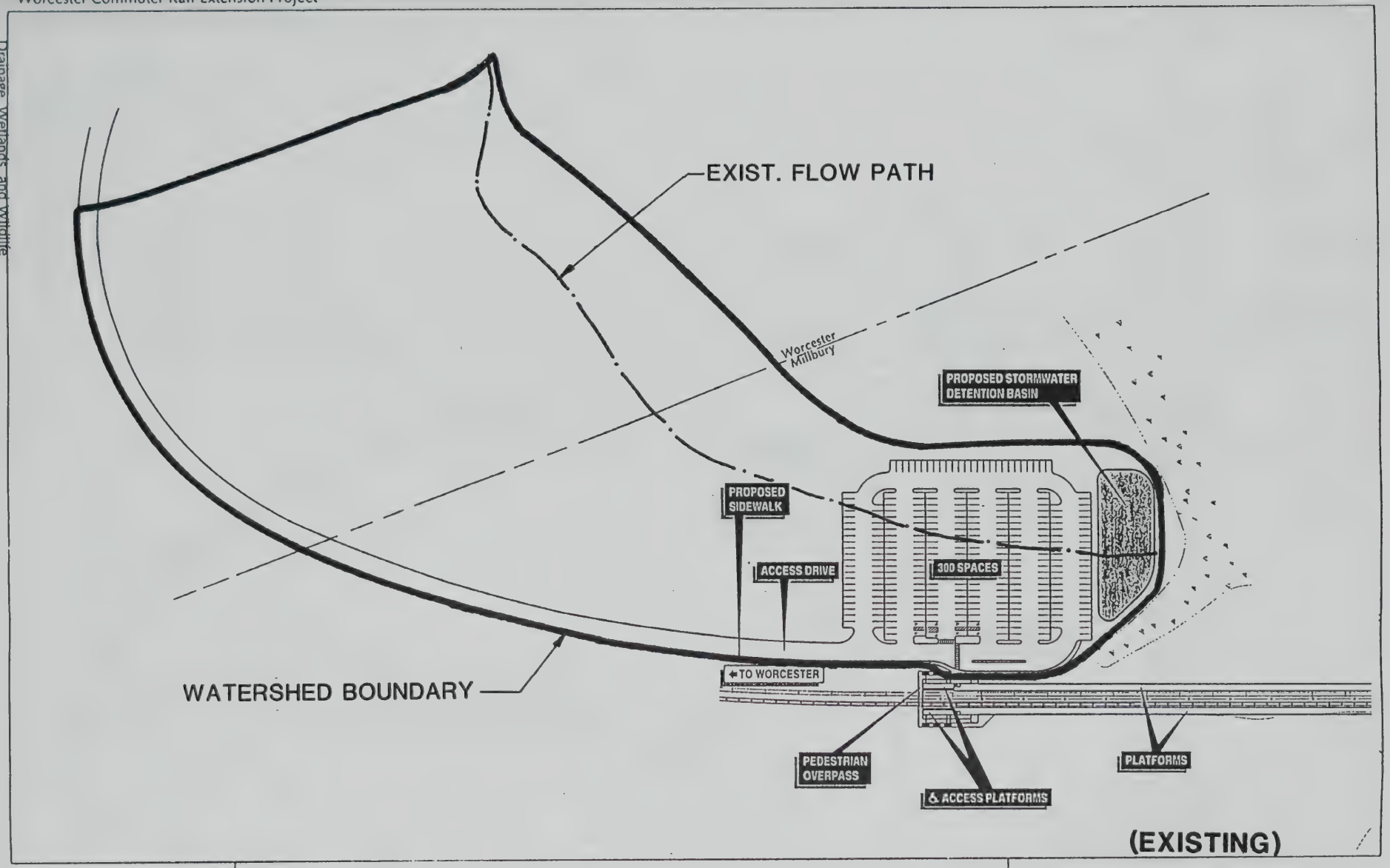
The following Table demonstrates the existing and proposed peak runoff quantities for a 10 year and 100 year design storm.

Table 5.3-4 Peak Runoff Rates - Millbury Station - Route 20 Alternative (North)

Storm Event	Existing Conditions	Proposed Conditions
10 Year	11.7 cfs	10.4 cfs
100 Year	28.8 cfs	21.8 cfs

Conclusions

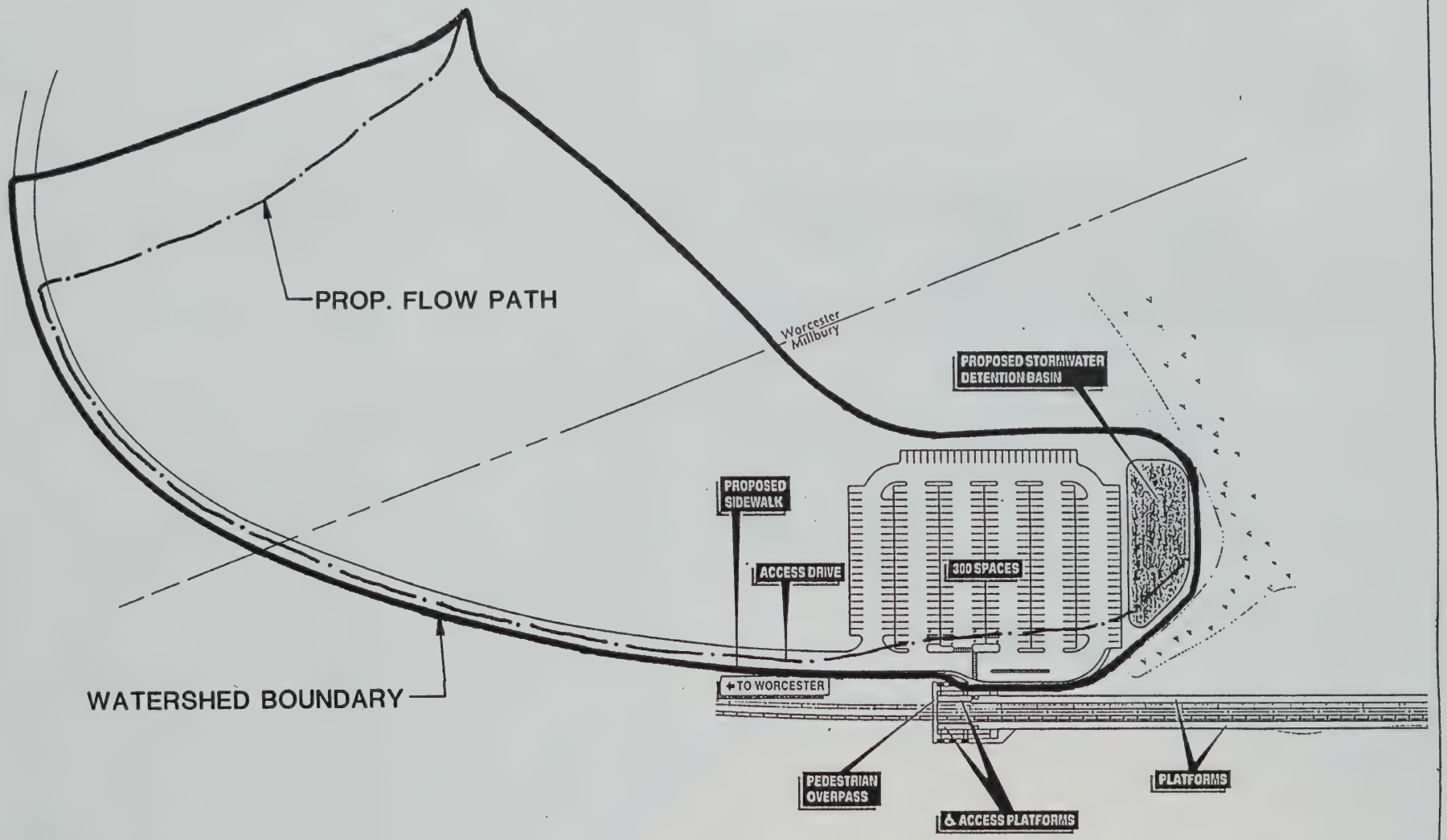
The detention basin has been designed to adequately accommodate the increased runoff generated from proposed construction. The existing condition peak flow rate has not been exceeded. No flooding impacts will result from construction of this station site.



Massachusetts Bay Transportation Authority

Approx. Scale: 1"=200'
0 200'

WATERSHED PLAN
ROUTE 20 ALTERNATIVE
MILLBURY, MA
FIGURE 5.3.B-1



(PROPOSED)

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200'
0 200'

WATERSHED PLAN
ROUTE 20 ALTERNATIVE
MILLBURY, MA
FIGURE 5.3.B-2

Table 5.3-5 Watershed Data - Existing Conditions Millbury Station - Route 20 Alternative (North)
A = 18.1 AC
Wooded
HSG: "B"
L_1 = 50', S=1% (sheet flow), H
L_2 = 1400', S=6% (shallow concentrated), U

From TR-55	CN = 60	
	TOC = .38 hrs = 23 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	1.02 in	2.26 in
Unit Peak Discharge (cfs/acre/in)	.607	.658
Peak Discharge	11 cfs (11.21)	27 cfs (26.92)

Table 5.3-6 Watershed Data - Proposed Conditions Millbury Station - Route 20 Alternative (North)
A = 18.1 AC
3.4 AC Pavement, 14.7 AC Wooded
HSG: "B"
L_1 = 50′, S=1% (sheet flow), H
L_2 = 650′, S=10% (shallow concentrated), U
L_3 = 1850′, (open channel) <V=3 fps assumed>

From TR-55	CN = 67	
	TOC = .48 hrs = 29 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	1.46 in	2.91 in
Unit Peak Discharge (cfs/acre/in)	.591	.626
Peak Discharge	16 cfs (15.62)	33 cfs (32.97)

Detention Pond Parameters

This detention basin in designed with three horizontal to one vertical (3:1) sideslopes. The outlet device will be a 24" diameter reinforced concrete pipe. It has been modelled to act as a culvert with no tail water effects. The discharge will be very near the adjacent wetland boundary. Outlets are to include a rip rap apron to slow velocities and dissipate hydraulic energies. The bottom and sides of the basin will be loamed and seeded.

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-NORTH User: RLD Date: 06-23-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
OTHER AGRICULTURAL LANDS					
Woods	fair	-	18.1(60)	-	-
Total Area (by Hydrologic Soil Group)			18.1		

SUBAREA: ONE TOTAL DRAINAGE AREA: 18.1 Acres WEIGHTED CURVE NUMBER:60*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-NORTH User: RLD Date: 06-23-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.01	H					0.280
Shallow Concent'd		1400	.06	U					0.098
								Time of Concentration =	0.38*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-NORTH User: RLD Date: 06-23-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		-	3.4(98)	-	-
OTHER AGRICULTURAL LANDS					
Woods	fair	-	14.7(60)	-	-
Total Area (by Hydrologic Soil Group)			18.1		

SUBAREA: ONE TOTAL DRAINAGE AREA: 18.1 Acres WEIGHTED CURVE NUMBER:67*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T MILLBURY STA-NORTH User: RLD Date: 06-23-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.2	50	.01	H					0.271
Shallow Concent'd		650	.10	U					0.035
Open Channel		1850						3	0.171
								Time of Concentration =	0.48*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

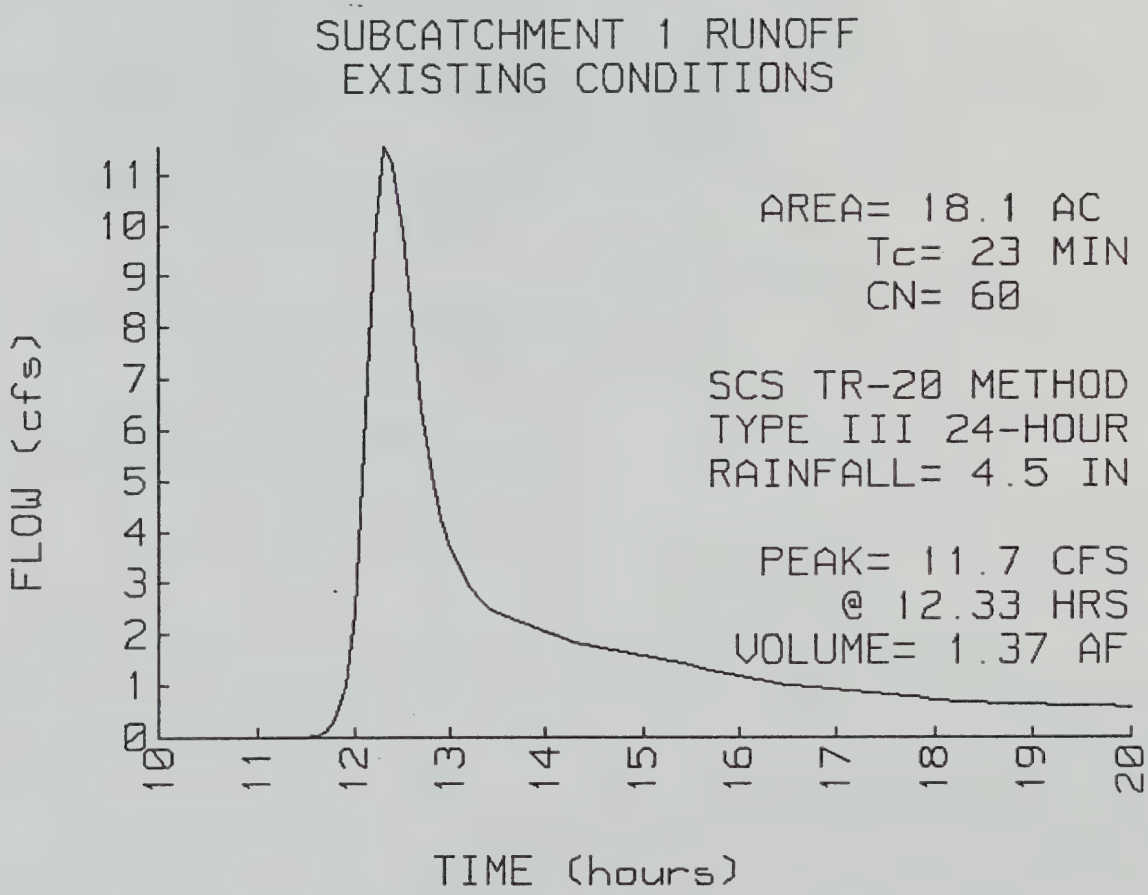
* - Generated for use by GRAPHIC method

SUBCATCHMENT 1 **EXISTING CONDITIONS** 10 YEAR STORM

ACRES	CN	
18.10	60	WOODED

AREA= 18.10 AC Tc= 23 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 11.7 CFS @ 12.33 HRS
VOLUME= 1.37 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 11.7 CFS @ 12.33 HOURS

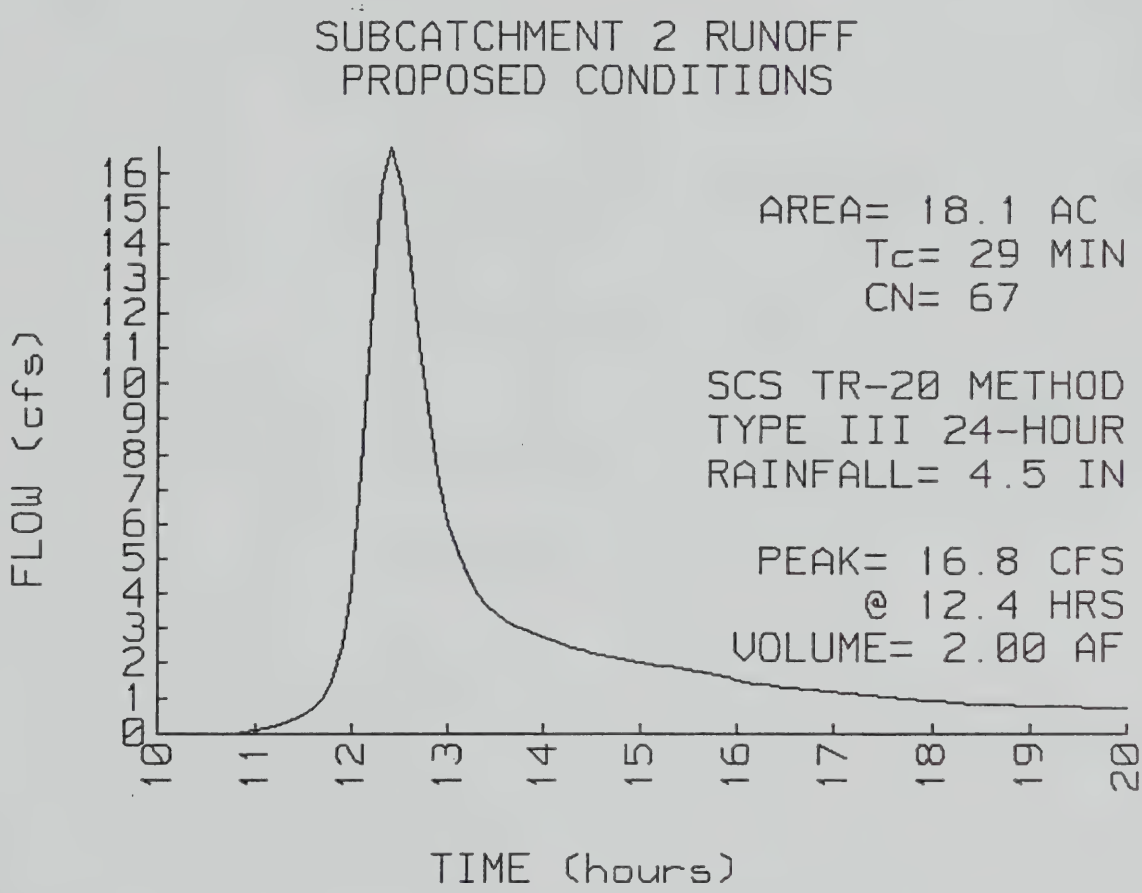
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.4	1.0
12.00	2.4	5.7	9.6	11.5	11.2	9.8	8.1	6.4	5.1	4.2
13.00	3.7	3.2	2.9	2.7	2.5	2.4	2.3	2.2	2.2	2.1
14.00	2.0	2.0	1.9	1.8	1.8	1.8	1.7	1.7	1.6	1.6
15.00	1.6	1.5	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.2
16.00	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	.9
17.00	.9	.9	.9	.9	.8	.8	.8	.8	.8	.7
18.00	.7	.7	.7	.7	.7	.7	.7	.6	.6	.6
19.00	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6
20.00	.6									

SUBCATCHMENT 2 **PROPOSED CONDITIONS** 10 YEAR STORM

ACRES	CN	
3.40	98	PAVED ACCESS DRIVE AND LOT
14.70	60	WOODED
18.10	67	

AREA= 18.10 AC Tc= 29 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 16.8 CFS @ 12.40 HRS
VOLUME= 2.00 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 16.8 CFS @ 12.40 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	.1	.1	.2	.3	.4	.5	.7	1.0	1.5	2.5
12.00	4.2	7.6	12.2	15.8	16.8	15.6	13.4	11.1	8.9	7.2
13.00	6.0	5.2	4.5	4.0	3.7	3.4	3.2	3.1	3.0	2.8
14.00	2.7	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.1	2.1
15.00	2.0	2.0	1.9	1.9	1.8	1.8	1.7	1.7	1.6	1.6
16.00	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2
17.00	1.2	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
18.00	.9	.9	.9	.9	.8	.8	.8	.8	.8	.8
19.00	.8	.8	.8	.8	.8	.8	.7	.7	.7	.7
20.00	.7									

POND 2 **DETENTION POND** 10 YEAR STORM

STARTING ELEV= 386.0 FT
FLOOD ELEV= 390.0 FT

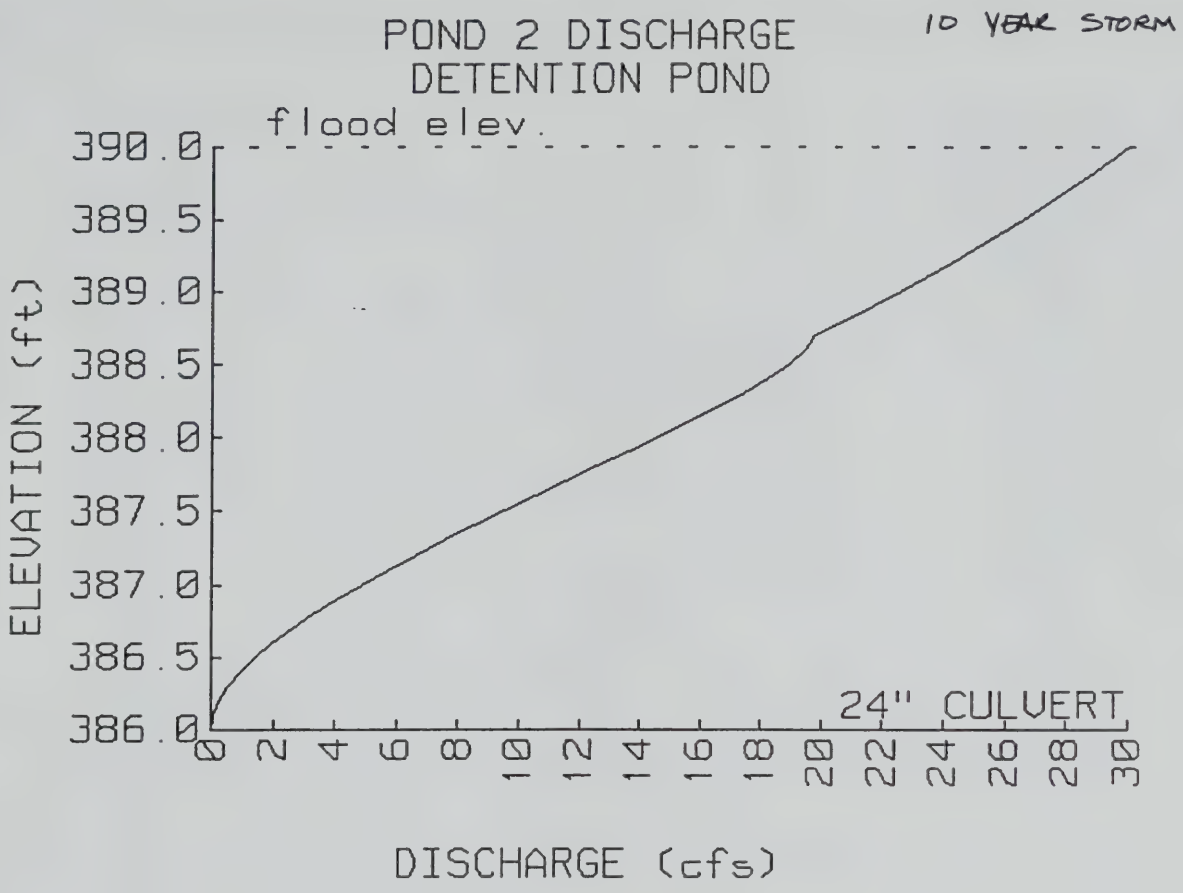
ELEVATION (FT)	CUM.STOR (AF)
386.0	0.00
386.5	.15
387.0	.30
387.5	.47
388.0	.64
389.0	1.01
390.0	1.80

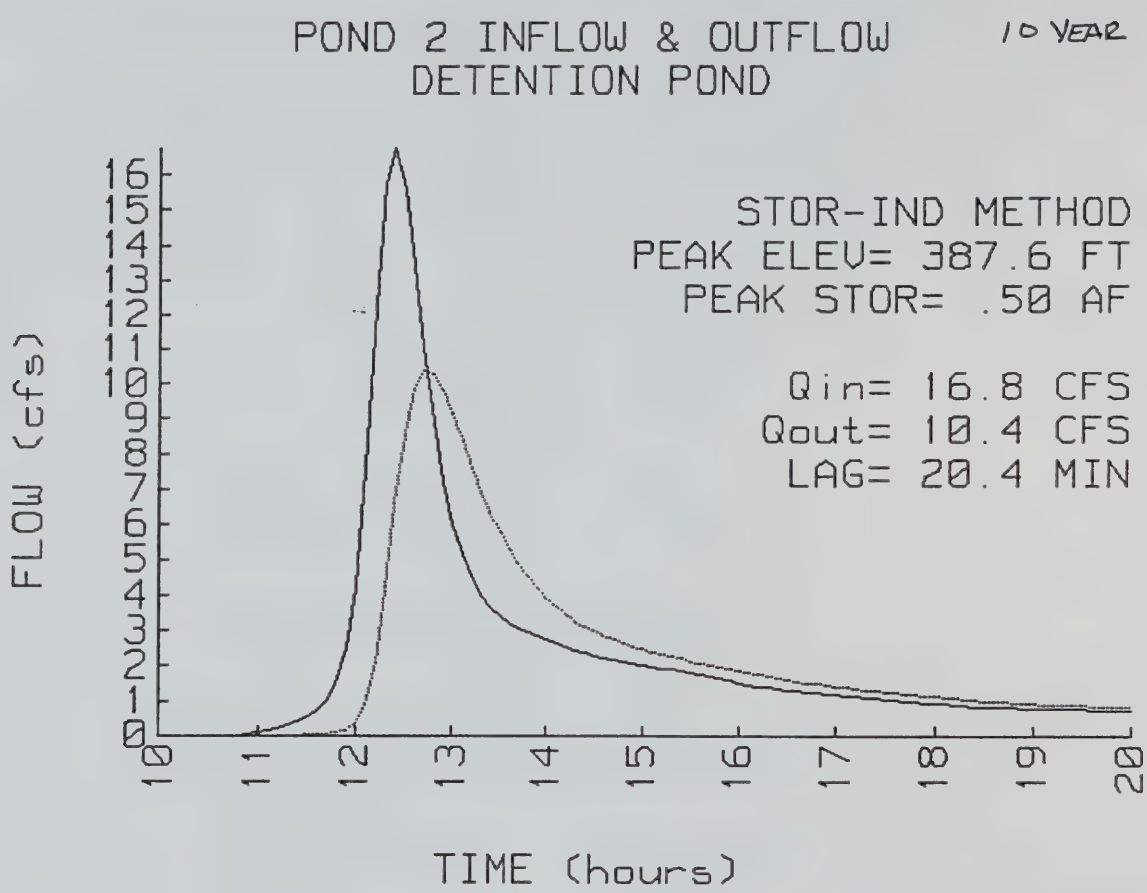
STOR-IND METHOD
PEAK ELEVATION= 387.6 FT
PEAK STORAGE = .50 AF
Qin = 16.8 CFS @ 12.40 HRS
Qout= 10.4 CFS @ 12.74 HRS
ATTEN= 38 % LAG= 20.4 MIN
IN/OUT= 2.00 / 1.89 AF

INVERT (FT)	OUTLET DEVICES
386.0	**24" CULVERT**
	n=.013 L=30' S=.01'/' Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
386.0	0.0	.1	.2	.5	.9	1.4	2.0	2.6	3.3	4.0
387.0	4.9	5.7	6.6	7.6	8.5	9.5	10.5	11.6	12.6	13.6
388.0	14.6	15.6	16.5	17.4	18.2	18.9	19.4	19.8	20.8	21.7
389.0	22.6	23.4	24.2	25.0	25.8	26.6	27.3	28.0	28.7	29.4
390.0	30.0									


POND 2 DISCHARGE
DETENTION POND
10 YEAR STORM
flood elev.
390.0
389.5
389.0
388.5
388.0
387.5
387.0
386.5
386.0
ELEVATION (ft)
24" CULVERT
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
DISCHARGE (cfs)



POND 2 **DETENTION POND**

OUTFLOW PEAK= 10.4 CFS @ 12.74 HOURS

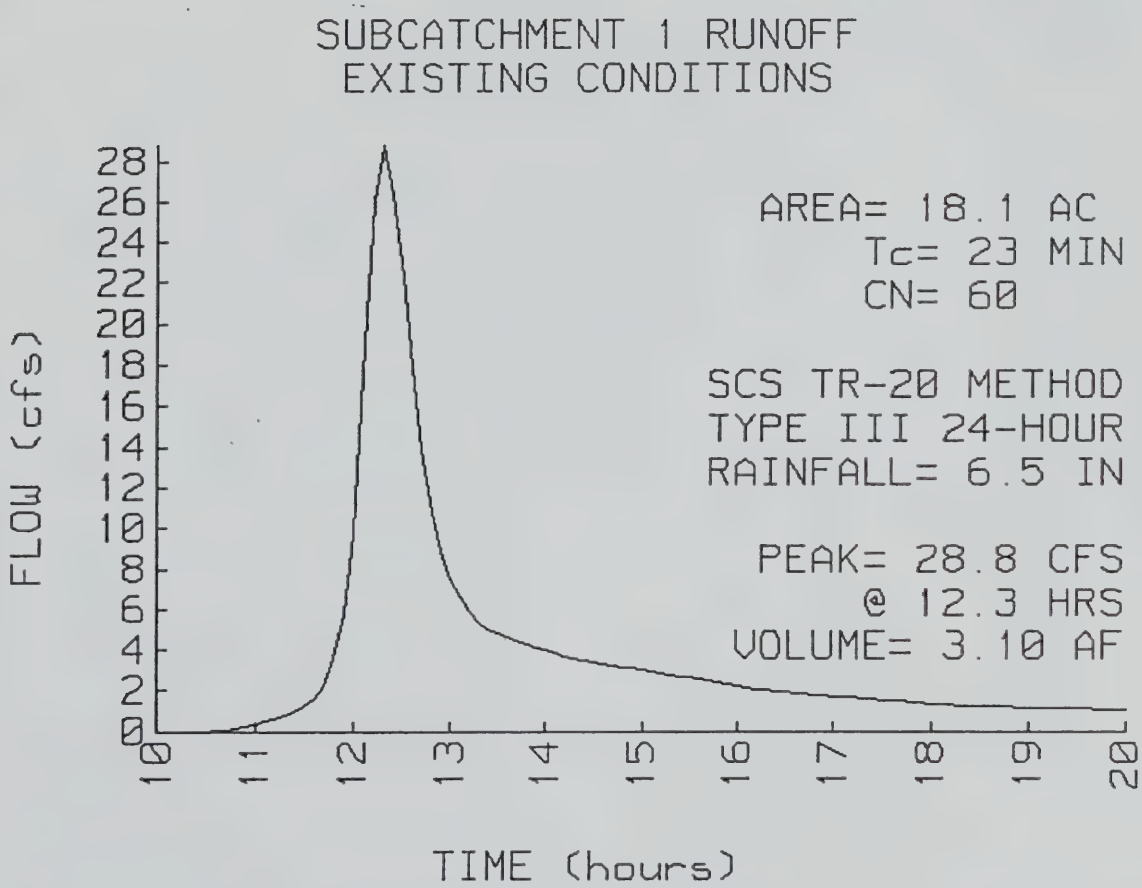
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2
12.00	.4	.9	2.1	4.2	6.6	8.6	9.8	10.4	10.3	9.8
13.00	9.1	8.4	7.6	6.9	6.3	5.8	5.3	4.9	4.5	4.2
14.00	3.9	3.7	3.5	3.3	3.1	3.0	2.9	2.8	2.7	2.6
15.00	2.5	2.4	2.3	2.3	2.2	2.1	2.1	2.0	2.0	1.9
16.00	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.4
17.00	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2
18.00	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	.9	.9
19.00	.9	.9	.9	.9	.9	.9	.8	.8	.8	.8
20.00	.8									

SUBCATCHMENT 1 **EXISTING CONDITIONS** 100 YEAR STORM

ACRES	CN	
18.10	60	WOODED

AREA= 18.10 AC Tc= 23 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 28.8 CFS @ 12.30 HRS
VOLUME= 3.10 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 28.8 CFS @ 12.30 HOURS

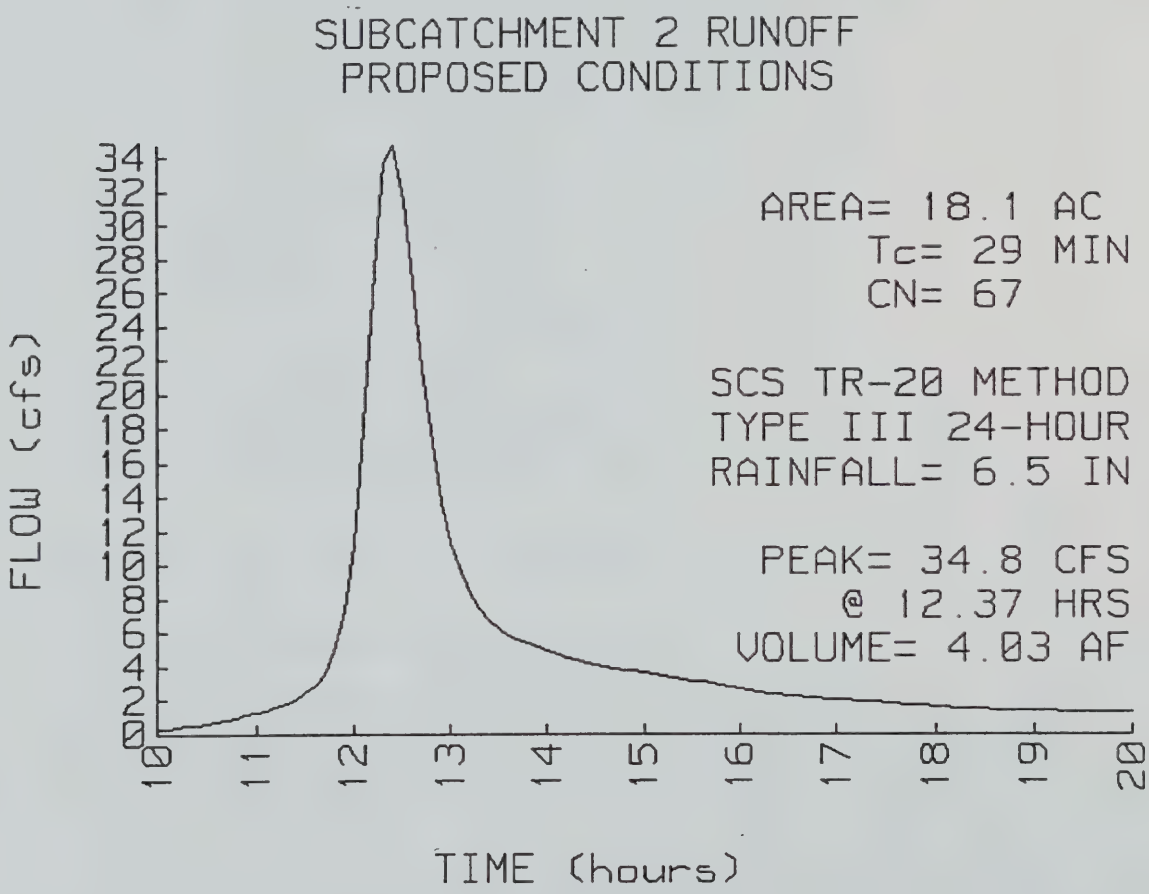
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.3
11.00	.4	.5	.6	.8	1.0	1.2	1.6	2.3	3.6	5.8
12.00	9.8	17.5	26.0	28.8	26.4	22.3	17.9	13.9	10.8	8.8
13.00	7.5	6.6	5.9	5.4	5.0	4.8	4.6	4.4	4.3	4.1
14.00	4.0	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.2	3.1
15.00	3.0	2.9	2.9	2.8	2.7	2.6	2.5	2.5	2.4	2.3
16.00	2.2	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.8
17.00	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.4
18.00	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2
19.00	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
20.00	1.1									

SUBCATCHMENT 2 **PROPOSED CONDITIONS** 100 YEAR STORM

ACRES	CN	
3.40	98	PAVED ACCESS DRIVE AND LOT
14.70	60	WOODED
18.10	67	

AREA= 18.10 AC Tc= 29 MIN PEAK= 34.8 CFS @ 12.37 HRS

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
VOLUME= 4.03 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 34.8 CFS @ 12.37 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.3	.3	.4	.5	.6	.7	.8	.9	1.0	1.1
11.00	1.3	1.4	1.6	1.8	2.1	2.4	2.9	3.6	4.9	7.3
12.00	11.2	18.2	27.3	33.7	34.7	31.5	26.5	21.5	17.1	13.7
13.00	11.3	9.6	8.3	7.4	6.7	6.2	5.9	5.6	5.3	5.1
14.00	4.9	4.7	4.5	4.4	4.2	4.1	4.0	3.9	3.8	3.7
15.00	3.6	3.5	3.4	3.3	3.2	3.2	3.1	3.0	2.9	2.8
16.00	2.7	2.6	2.5	2.4	2.3	2.3	2.2	2.2	2.1	2.1
17.00	2.0	2.0	2.0	1.9	1.9	1.8	1.8	1.7	1.7	1.7
18.00	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4
19.00	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2
20.00	1.2									

POND 2 **DETENTION POND** 100 YEAR STORM

STARTING ELEV= 386.0 FT
FLOOD ELEV= 390.0 FT

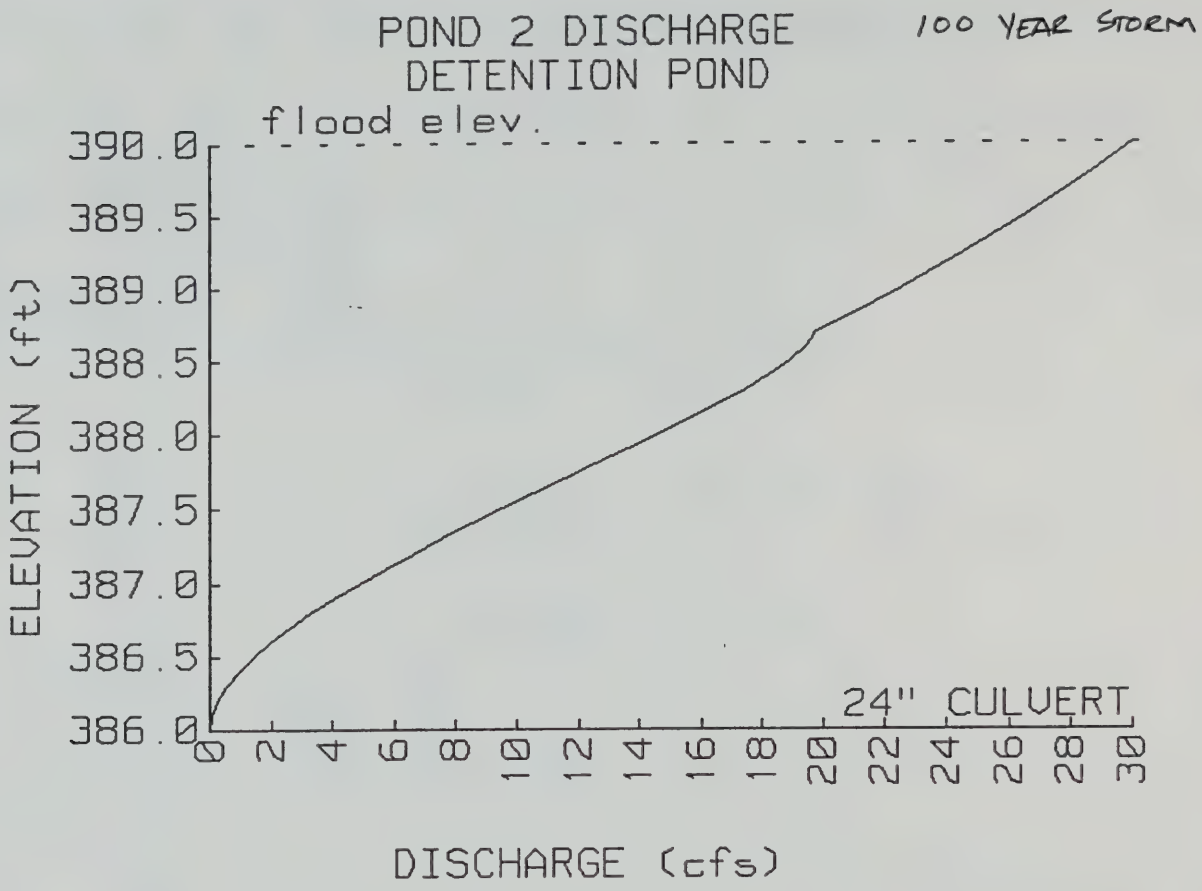
ELEVATION (FT)	CUM.STOR (AF)
386.0	0.00
386.5	.15
387.0	.30
387.5	.47
388.0	.64
389.0	1.01
390.0	1.80

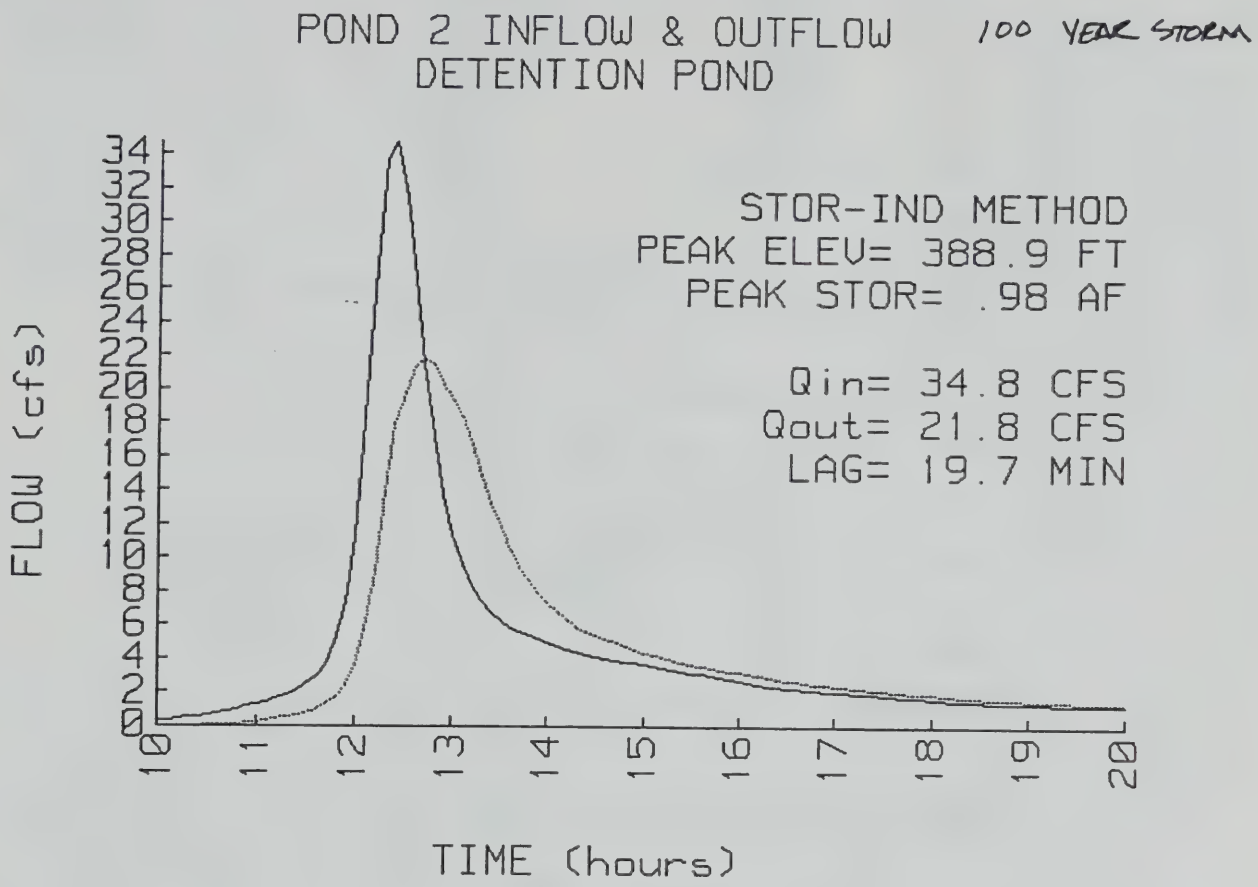
STOR-IND METHOD
PEAK ELEVATION= 388.9 FT
PEAK STORAGE = .98 AF
Qin = 34.8 CFS @ 12.37 HRS
Qout= 21.8 CFS @ 12.70 HRS
ATTEN= 37 % LAG= 19.7 MIN
IN/OUT= 4.03 / 3.88 AF

INVERT (FT)	OUTLET DEVICES
386.0	**24" CULVERT**
	n=.013 L=30′ S=.01′/′ Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
386.0	0.0	.1	.2	.5	.9	1.4	2.0	2.6	3.3	4.0
387.0	4.9	5.7	6.6	7.6	8.5	9.5	10.5	11.6	12.6	13.6
388.0	14.6	15.6	16.5	17.4	18.2	18.9	19.4	19.8	20.8	21.7
389.0	22.6	23.4	24.2	25.0	25.8	26.6	27.3	28.0	28.7	29.4
390.0	30.0									


POND 2 DISCHARGE
DETENTION POND
100 YEAR STORM
flood elev.
390.0
389.5
389.0
388.5
388.0
387.5
387.0
386.5
386.0
ELEVATION (ft)
24" CULVERT
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
DISCHARGE (cfs)



POND 2 **DETENTION POND**

OUTFLOW PEAK= 21.8 CFS @ 12.70 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.1
11.00	.2	.3	.4	.5	.6	.8	1.0	1.2	1.6	2.3
12.00	3.5	5.7	9.2	13.9	17.8	19.7	21.3	21.8	21.3	20.2
13.00	19.3	18.2	16.6	14.9	13.2	11.7	10.5	9.4	8.6	7.9
14.00	7.3	6.8	6.3	6.0	5.6	5.4	5.1	4.9	4.7	4.5
15.00	4.3	4.2	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3
16.00	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.6	2.5	2.4
17.00	2.4	2.3	2.3	2.2	2.2	2.1	2.1	2.0	2.0	1.9
18.00	1.9	1.8	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.5
19.00	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4
20.00	1.3									

5.3.C Grafton Station

Objective

To provide a zero net increase to the peak flow rate as storm water enters the existing wetland system adjacent to the station site.

Assumptions and Methodologies

The design storm has been modelled as a Type III storm in Worcester County. This results with a 4.5 in. and 6.5 in. 24 hour rainfall for the 10 year and 100 year design storm, respectively. The site drainage area is assumed to be half wooded and half grass land in the existing condition.

Summary of Peak Flows

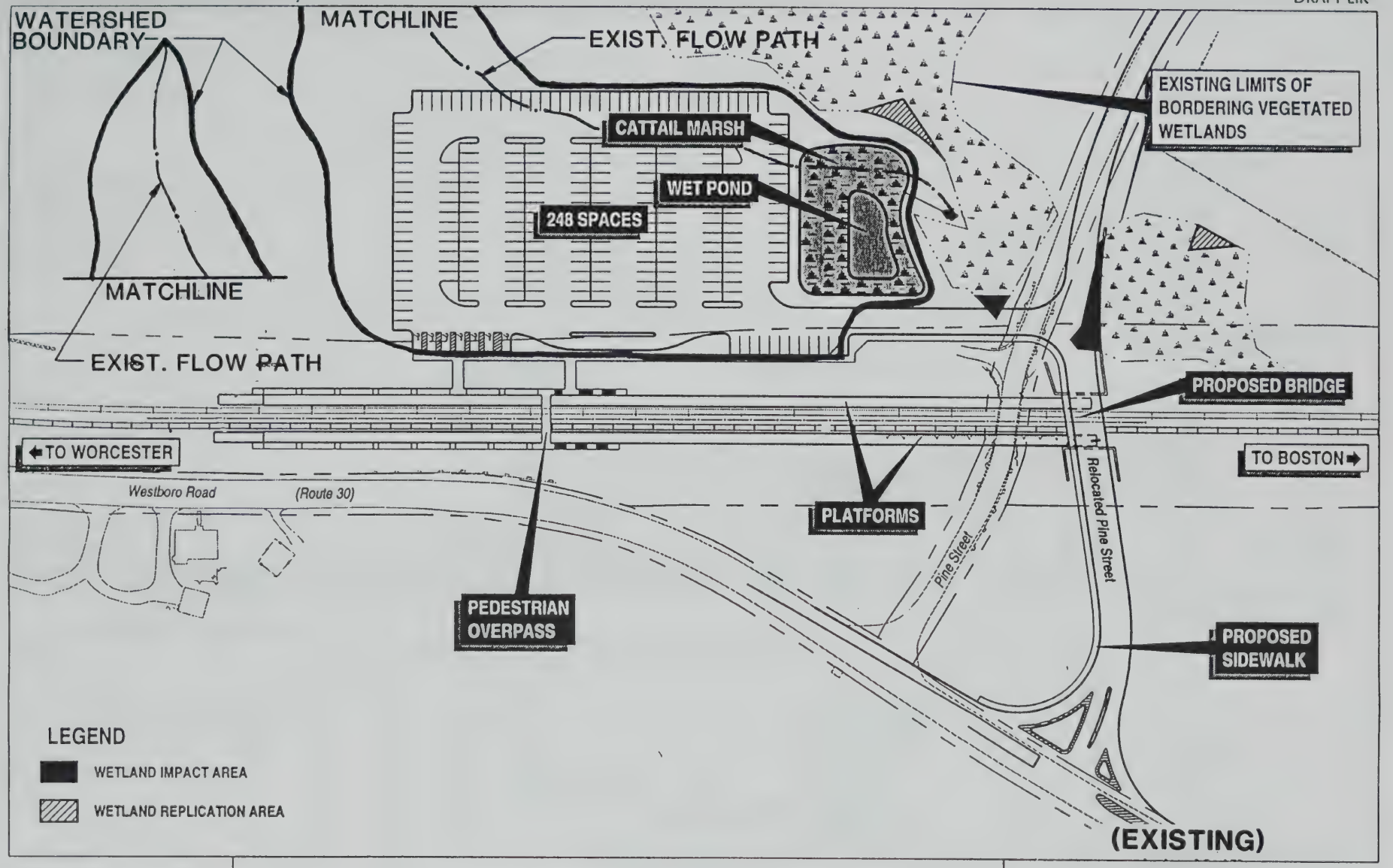
The following Table demonstrates the existing and proposed peak runoff quantities for a 10 year and 100 year design storm.

Table 5.3-7 Peak Runoff Rates - Grafton Station

Storm Event	Existing Conditions	Proposed Conditions
10 Year	4.9 cfs	3.7 cfs
100 Year	10.0 cfs	5.6 cfs

Conclusions

The detention basin has been designed to adequately accommodate the increased runoff generated from proposed construction. The existing condition peak flow rate has not been exceeded. No flooding impacts will result from construction of this station site.

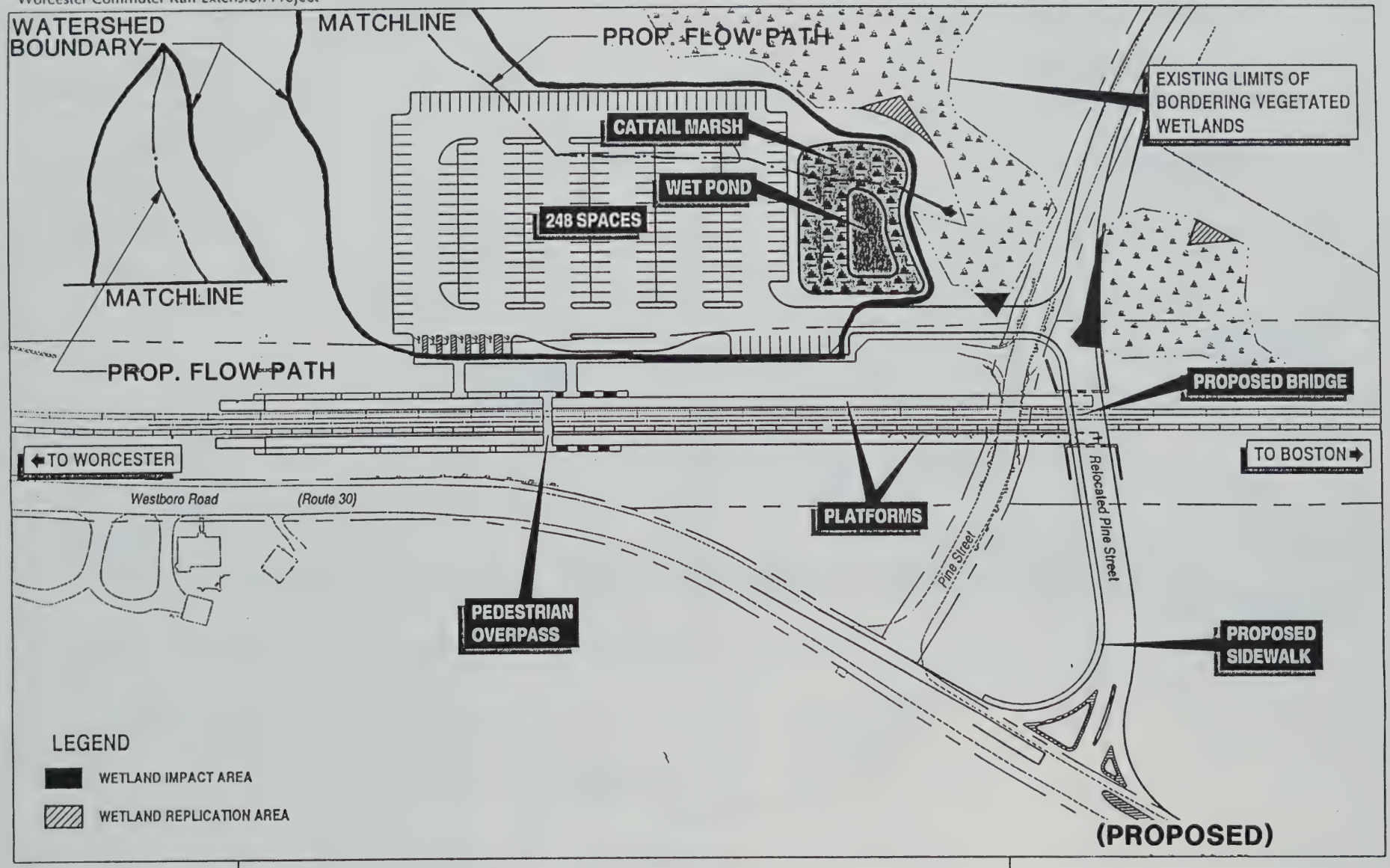


Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

WATERSHED PLAN
GRAFTON, MA

FIGURE 5.3.C-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

WATERSHED PLAN
GRAFTON, MA

FIGURE 5.3.C-2

Table 5.3-8 Watershed Data - Existing Conditions Grafton Station
A = 3.7 AC
50% Treed (1.85 AC), 50% Grassland/Range (1.85 AC)
HSG:
70% "B", 30% "C" (assume all soil type B is grassland)
L_1 = 50′, S=4% assumed (sheet flow), H
L_2 = 300′, S=19% (shallow concentrated), U
L_3 = 430′, S=3% (shallow concentrated), U

From TR-55	CN = 68	
	TOC = .22 hrs = 13 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	1.53 in	3.01 in
Unit Peak Discharge (cfs/acre/in)	.794	.833
Peak Discharge	5 cfs (4.50)	9 cfs (9.25)

Table 5.3-9 Watershed Data - Proposed Conditions Grafton Station
A = 3.7 AC
2.3 AC Pavement, .9 AC Treed, .5 AC Grassland/Range
HSG:
2.3 AC "B", .9 AC "C", .5 AC "B"
L_1 = 50′, S=4% (sheet flow), H
L_2 = 300′, S=19% (shallow concentrated), U
L_3 = 200′, S=2% (shallow concentrated), P
L_4 = 200′, (open channel), <V=3 fps assumed>

From TR-55	CN = 80	
	TOC = .20 hrs = 12 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	3.20 in	5.11 in
Unit Peak Discharge (cfs/acre/in)	.883	.833
Peak Discharge	10 cfs (10.45)	17 cfs (16.66)

Detention Pond Parameters

This detention basin in designed with three horizontal to one vertical (3:1) sideslopes. The outlet device will be a 12" diameter reinforced concrete pipe. It has been modelled to act as a culvert with no tail water effects. The discharge will be very near the adjacent wetland boundary. Water quality BMP's will include a wet pond and cattail marsh located within the detention basin. Outlets are to include a rip rap apron to slow velocities and dissipate hydraulic energies. The bottom and sides of the basin will be loamed and seeded.

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T GRAFTON STATION User: RLD Date: 06-29-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	-	1.85(69)	-	-
Woods	fair	-	.74(60)	1.11(73)	-
Total Area (by Hydrologic Soil Group)			2.59	1.11	

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.7 Acres WEIGHTED CURVE NUMBER:68*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T GRAFTON STATION User: RLD Date: 06-29-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.04	H					0.161
Shallow Concent'd		300	.19	U					0.012
Shallow Concent'd		430	.03	U					0.043

Time of Concentration = 0.22*
=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T GRAFTON STATION User: RLD Date: 06-29-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		-	2.3(98)	-	-
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	-	.50(69)	-	-
Woods	fair	-	-	.9(73)	-
Total Area (by Hydrologic Soil Group)			2.8	.9	

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.7 Acres WEIGHTED CURVE NUMBER:88*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T GRAFTON STATION User: RLD Date: 06-29-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.04	H					0.161
Shallow Concent'd		300	.19	U					0.012
Shallow Concent'd		200	.04	P					0.014
Open Channel		200						3	0.019
								Time of Concentration =	0.20*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

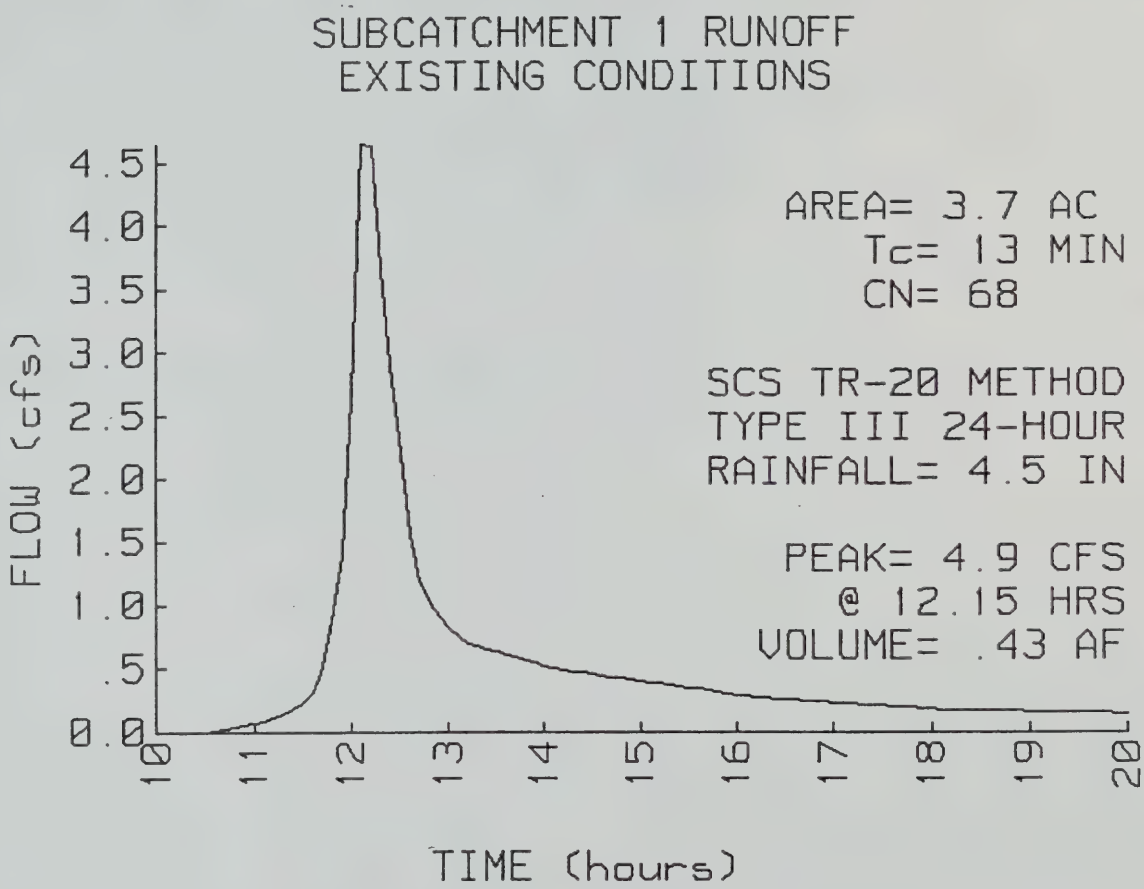
SUBCATCHMENT 1 **EXISTING CONDITIONS** 10 YEAR STORM

ACRES	CN
3.70	68

WEIGHTED CN FROM TR-55

AREA= 3.70 AC Tc= 13 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 4.9 CFS @ 12.15 HRS
VOLUME= .43 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 4.9 CFS @ 12.15 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	.1	.1	.1	.1	.2	.2	.3	.5	.9	1.4
12.00	2.6	4.6	4.6	3.7	2.9	2.2	1.6	1.2	1.0	.9
13.00	.8	.7	.7	.7	.6	.6	.6	.6	.6	.5
14.00	.5	.5	.5	.5	.5	.5	.4	.4	.4	.4
15.00	.4	.4	.4	.4	.4	.4	.3	.3	.3	.3
16.00	.3	.3	.3	.3	.3	.3	.3	.2	.2	.2
17.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.1	.1
20.00	.1									

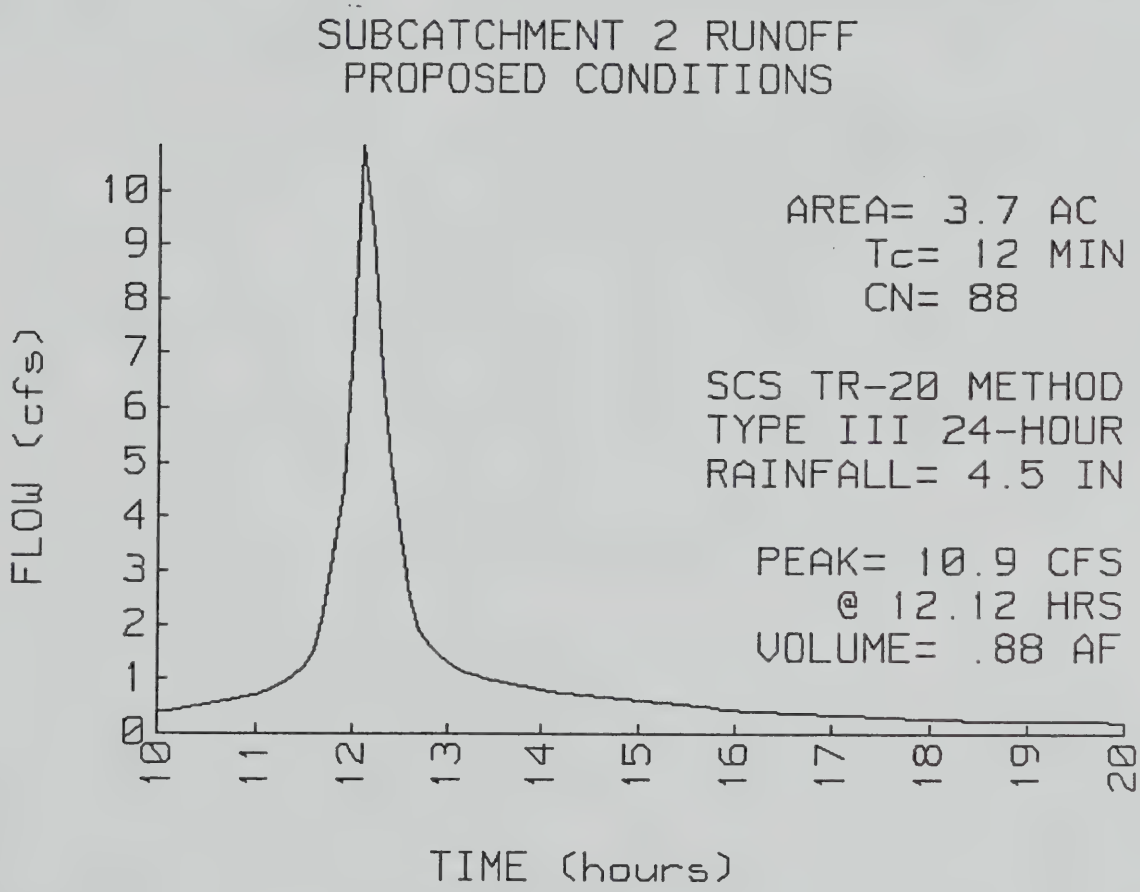
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 10 YEAR STORM

ACRES	CN
3.70	88

WEIGHTED CN FROM TR-55

AREA= 3.70 AC Tc= 12 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 10.9 CFS @ 12.12 HRS
VOLUME= .88 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 10.9 CFS @ 12.12 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.4	.4	.4	.5	.5	.5	.6	.6	.6	.7
11.00	.7	.8	.8	1.0	1.1	1.2	1.5	2.2	3.3	4.5
12.00	7.3	10.8	9.2	6.7	5.0	3.6	2.5	1.9	1.6	1.4
13.00	1.3	1.2	1.1	1.1	1.0	1.0	.9	.9	.9	.8
14.00	.8	.8	.7	.7	.7	.7	.7	.7	.6	.6
15.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.4
16.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.3
17.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
18.00	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

POND 2 **DETENTION BASIN** 10 YEAR STORM

STARTING ELEV= 396.6 FT
FLOOD ELEV= 404.0 FT

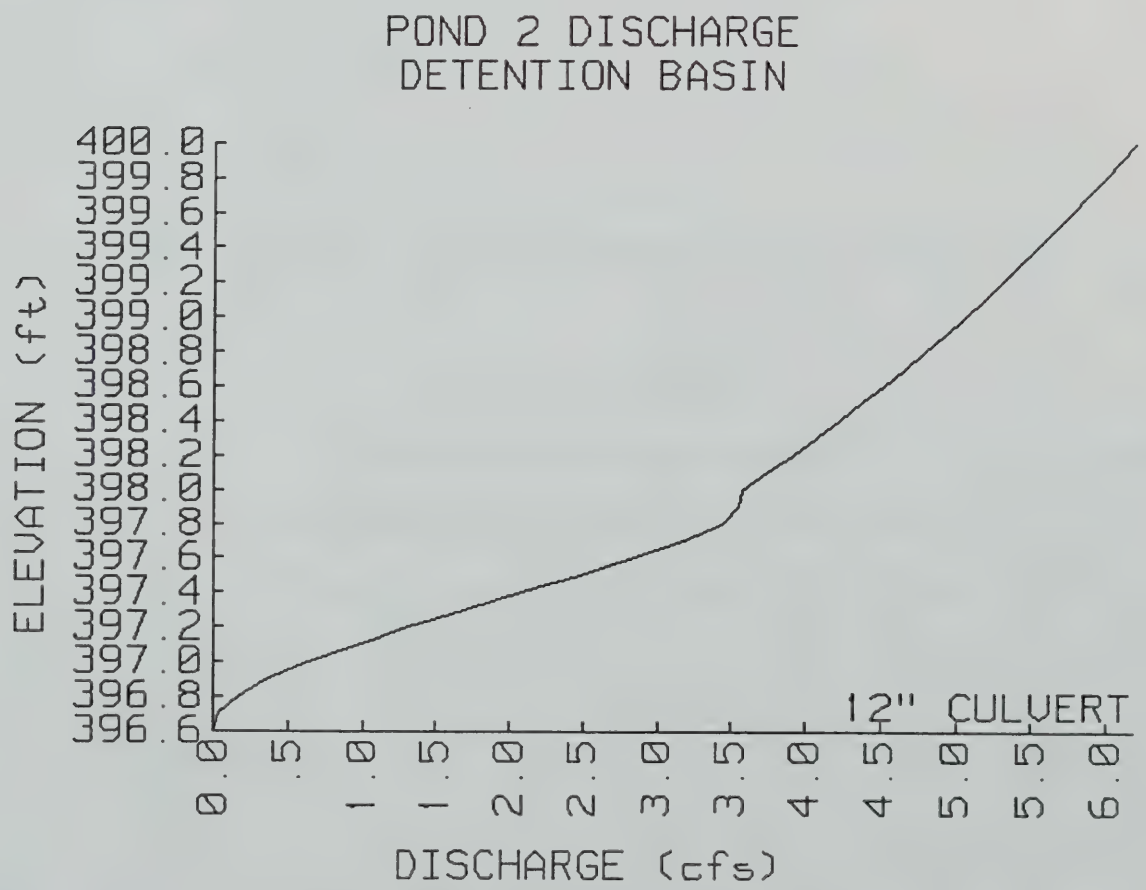
ELEVATION (FT)	CUM.STOR (AF)
396.6	0.00
397.0	.09
398.0	.33
400.0	.62

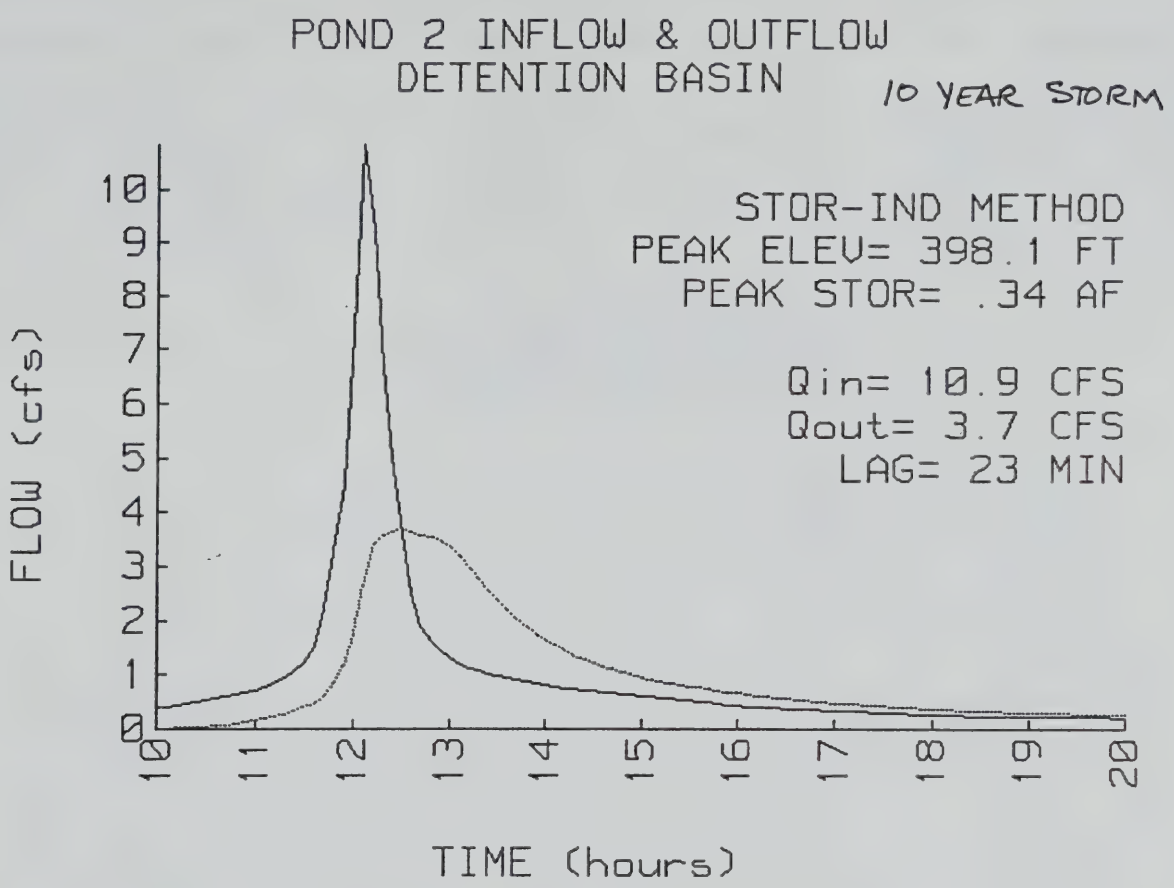
STOR-IND METHOD
PEAK ELEVATION= 398.1 FT
PEAK STORAGE = .34 AF
Qin = 10.9 CFS @ 12.12 HRS
Qout= 3.7 CFS @ 12.50 HRS
ATTEN= 66 % LAG= 23.0 MIN
IN/OUT= .88 / .83 AF

INVERT (FT)	OUTLET DEVICES
396.6	**12" CULVERT**
	n=.013 L=60′ S=.01′/′ Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
396.6	0.0	0.0	.2	.4	.6	1.0	1.3	1.7	2.1	2.5
397.6	2.8	3.2	3.4	3.5	3.6	3.7	3.9	4.1	4.2	4.4
398.6	4.5	4.7	4.8	4.9	5.0	5.2	5.3	5.4	5.5	5.6
399.6	5.8	5.9	6.0	6.1	6.2					





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= 3.7 CFS @ 12.50 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.1
11.00	.1	.2	.2	.3	.3	.4	.5	.6	.8	1.2
12.00	1.7	2.7	3.4	3.6	3.6	3.7	3.6	3.6	3.5	3.5
13.00	3.4	3.2	3.0	2.8	2.5	2.4	2.2	2.0	1.9	1.8
14.00	1.6	1.5	1.4	1.4	1.3	1.2	1.1	1.1	1.0	1.0
15.00	1.0	.9	.9	.8	.8	.8	.8	.7	.7	.7
16.00	.7	.6	.6	.6	.6	.6	.5	.5	.5	.5
17.00	.5	.5	.5	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.3	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

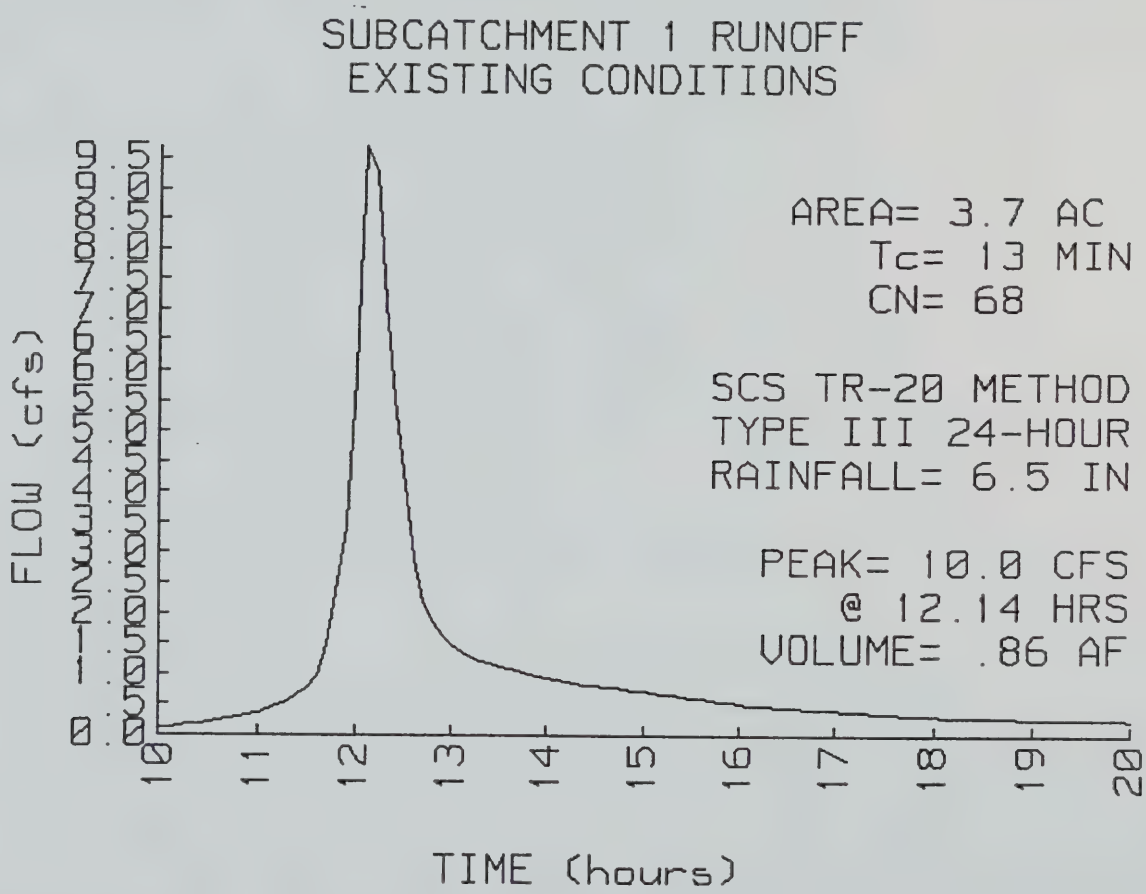
SUBCATCHMENT 1 **EXISTING CONDITIONS** 100 YEAR STORM

ACRES	CN
3.70	68

WEIGHTED CN FROM TR-55

AREA= 3.70 AC Tc= 13 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 10.0 CFS @ 12.14 HRS
VOLUME= .86 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 10.0 CFS @ 12.14 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.1	.1	.1	.2	.2	.2	.2	.3	.3	.3
11.00	.4	.4	.5	.6	.6	.8	1.0	1.5	2.3	3.4
12.00	5.9	9.7	9.2	7.1	5.5	4.1	2.9	2.2	1.8	1.6
13.00	1.5	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0
14.00	.9	.9	.9	.8	.8	.8	.8	.8	.7	.7
15.00	.7	.7	.7	.6	.6	.6	.6	.6	.5	.5
16.00	.5	.5	.5	.5	.5	.4	.4	.4	.4	.4
17.00	.4	.4	.4	.4	.4	.4	.3	.3	.3	.3
18.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.2									

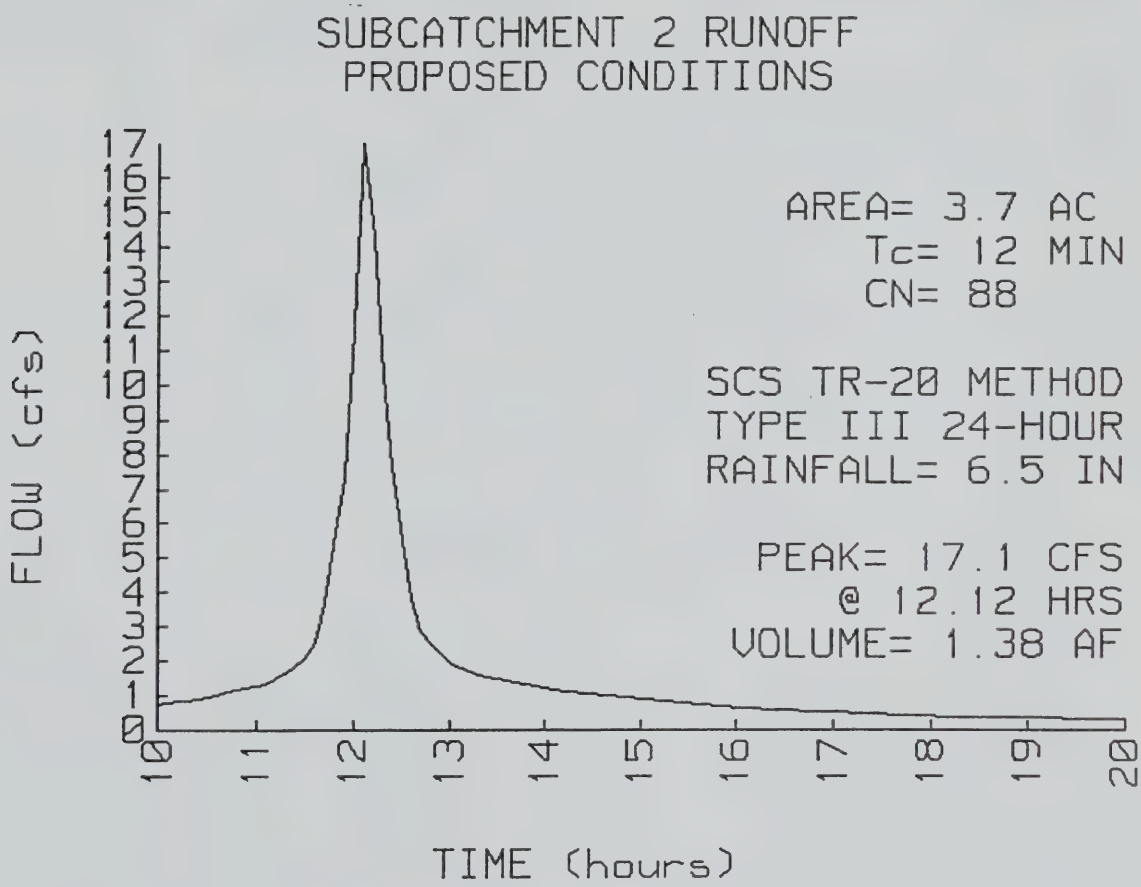
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 100 YEAR STORM

ACRES	CN
3.70	88

WEIGHTED CN FROM TR-55

AREA= 3.70 AC Tc= 12 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 17.1 CFS @ 12.12 HRS
VOLUME= 1.38 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 17.1 CFS @ 12.12 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.7	.8	.8	.9	.9	1.0	1.0	1.1	1.1	1.2
11.00	1.2	1.3	1.5	1.6	1.8	2.0	2.5	3.7	5.4	7.3
12.00	11.7	17.0	14.3	10.3	7.7	5.5	3.8	2.9	2.5	2.2
13.00	2.0	1.8	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3
14.00	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	.9
15.00	.9	.9	.9	.8	.8	.8	.7	.7	.7	.7
16.00	.6	.6	.6	.6	.6	.6	.6	.5	.5	.5
17.00	.5	.5	.5	.5	.5	.4	.4	.4	.4	.4
18.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

POND 2 **DETENTION BASIN** 100 YEAR STORM

STARTING ELEV= 396.6 FT
FLOOD ELEV= 404.0 FT

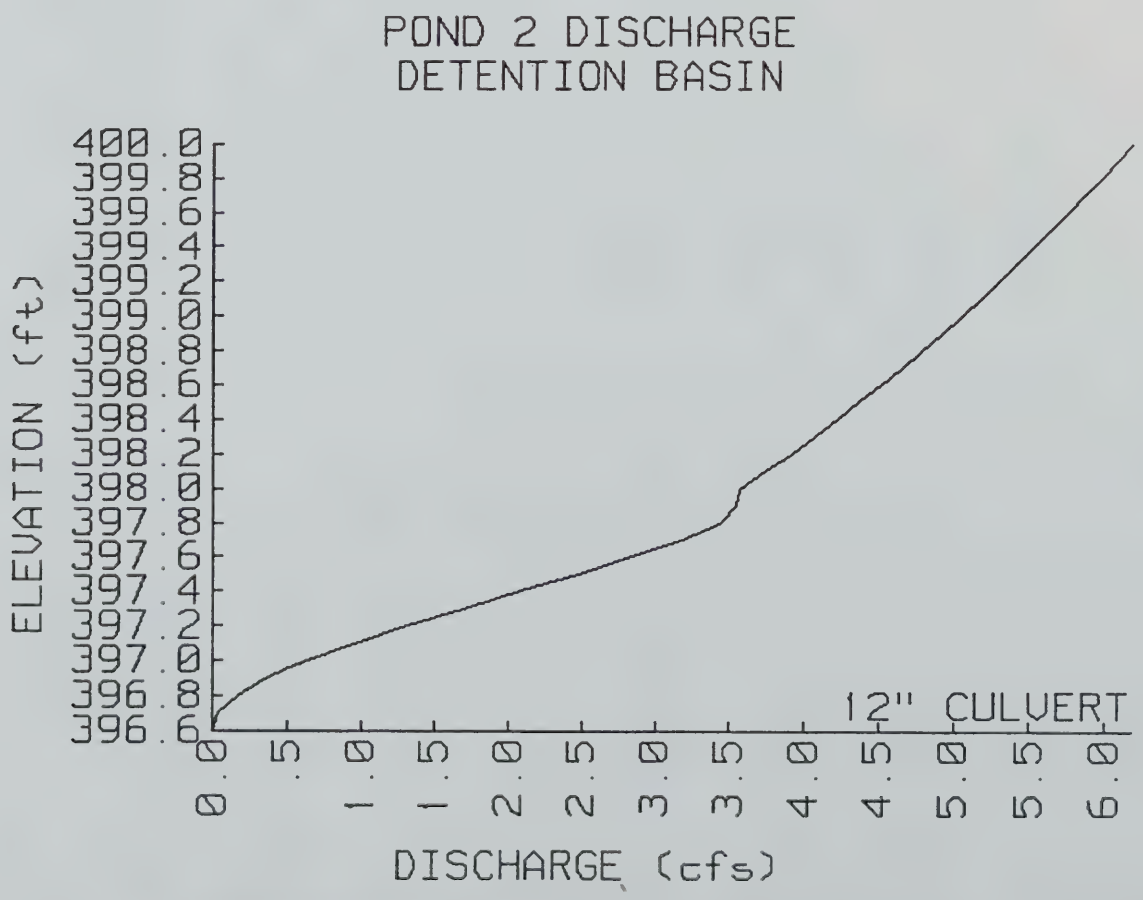
ELEVATION (FT)	CUM.STOR (AF)
396.6	0.00
397.0	.09
398.0	.33
400.0	.62

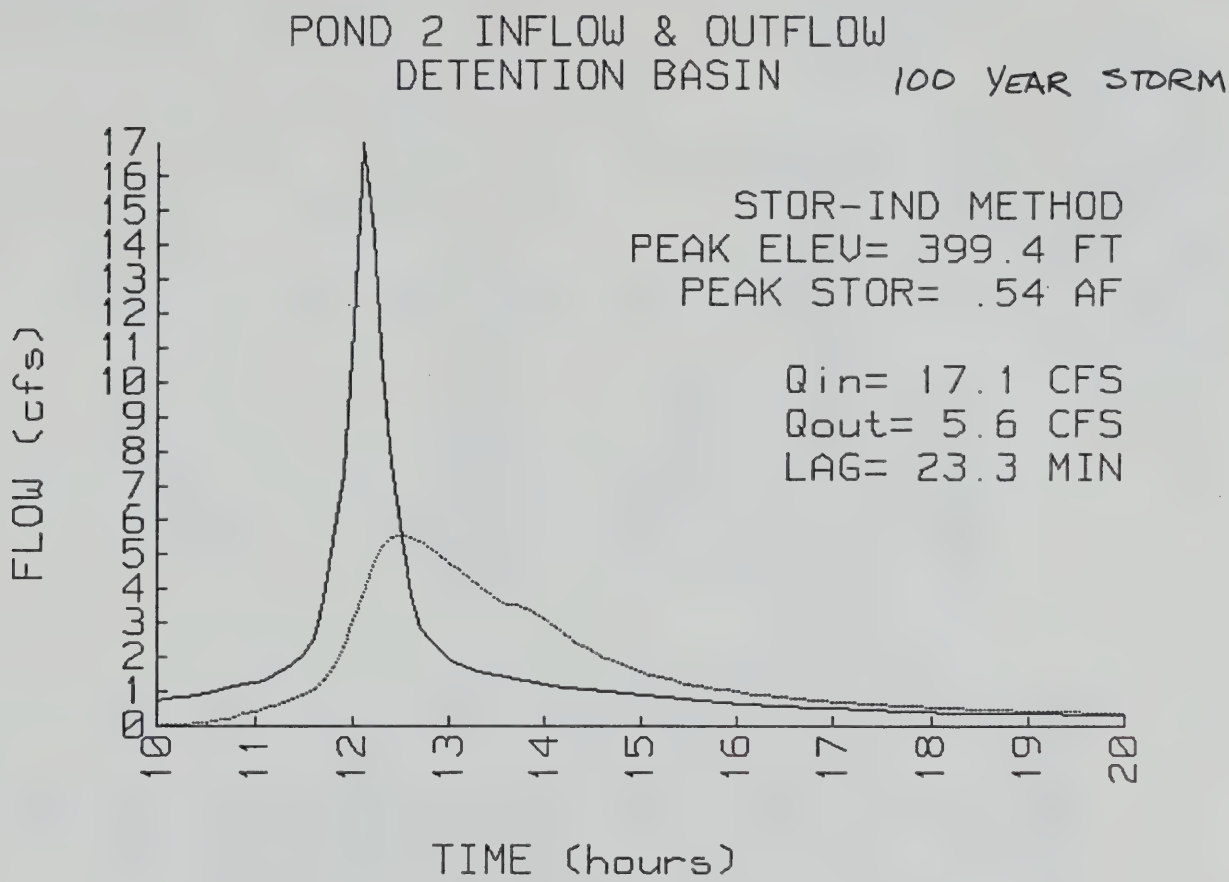
STOR-IND METHOD
PEAK ELEVATION= 399.4 FT
PEAK STORAGE = .54 AF
Qin = 17.1 CFS @ 12.12 HRS
Qout= 5.6 CFS @ 12.50 HRS
ATTEN= 67 % LAG= 23.3 MIN
IN/OUT= 1.38 / 1.31 AF

INVERT (FT)	OUTLET DEVICES
396.6	**12" CULVERT**
	n=.013 L=60′ S=.01′/′ Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
396.6	0.0	0.0	.2	.4	.6	1.0	1.3	1.7	2.1	2.5
397.6	2.8	3.2	3.4	3.5	3.6	3.7	3.9	4.1	4.2	4.4
398.6	4.5	4.7	4.8	4.9	5.0	5.2	5.3	5.4	5.5	5.6
399.6	5.8	5.9	6.0	6.1	6.2					





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= 5.6 CFS @ 12.50 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	.1	.1	.2	.2	.3	.3
11.00	.4	.5	.6	.7	.8	.9	1.1	1.3	1.7	2.3
12.00	3.1	3.7	4.7	5.2	5.5	5.6	5.5	5.4	5.2	5.0
13.00	4.8	4.6	4.3	4.1	3.9	3.7	3.6	3.5	3.4	3.3
14.00	3.1	2.9	2.7	2.5	2.3	2.2	2.0	1.9	1.8	1.7
15.00	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0
16.00	1.0	.9	.9	.9	.8	.8	.8	.8	.7	.7
17.00	.7	.7	.7	.6	.6	.6	.6	.6	.6	.5
18.00	.5	.5	.5	.5	.5	.5	.5	.4	.4	.4
19.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
20.00	.4									

5.3.D Westborough Station

Objective

To provide a zero net increase to the peak flow rate as storm water enters the existing wetland system adjacent to the station site.

Assumptions and Methodologies

The design storm has been modelled as a Type III storm in Worcester County. This results with a 4.5 in. and 6.5 in. 24 hour rainfall for the 10 year and 100 year design storm, respectively. The site drainage area is assumed to be mostly grassland with some wooded area in the existing condition.

Summary of Peak Flows

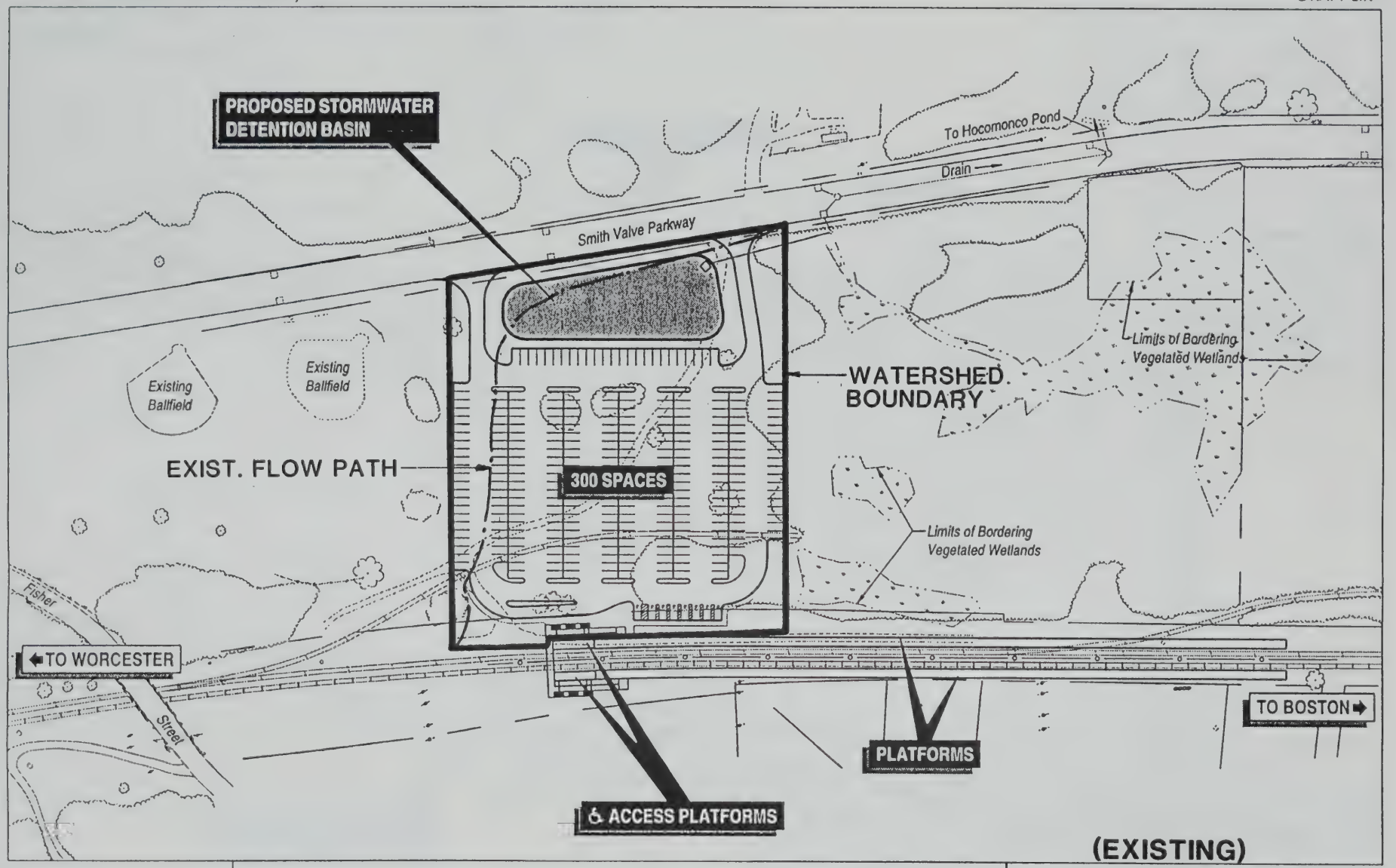
The following Table demonstrates the existing and proposed peak runoff quantities for a 10 year and 100 year design storm.

Table 5.3-10 Peak Runoff Rates - Westborough Station

Storm Event	Existing Conditions	Proposed Conditions
10 Year	0.5 cfs	0.5 cfs
100 Year	2.9 cfs	1.6 cfs

Conclusions

The detention basin has been designed to adequately accommodate the increased runoff generated from proposed construction. The existing condition peak flow rate has not been exceeded. No flooding impacts will result from construction of this station site.



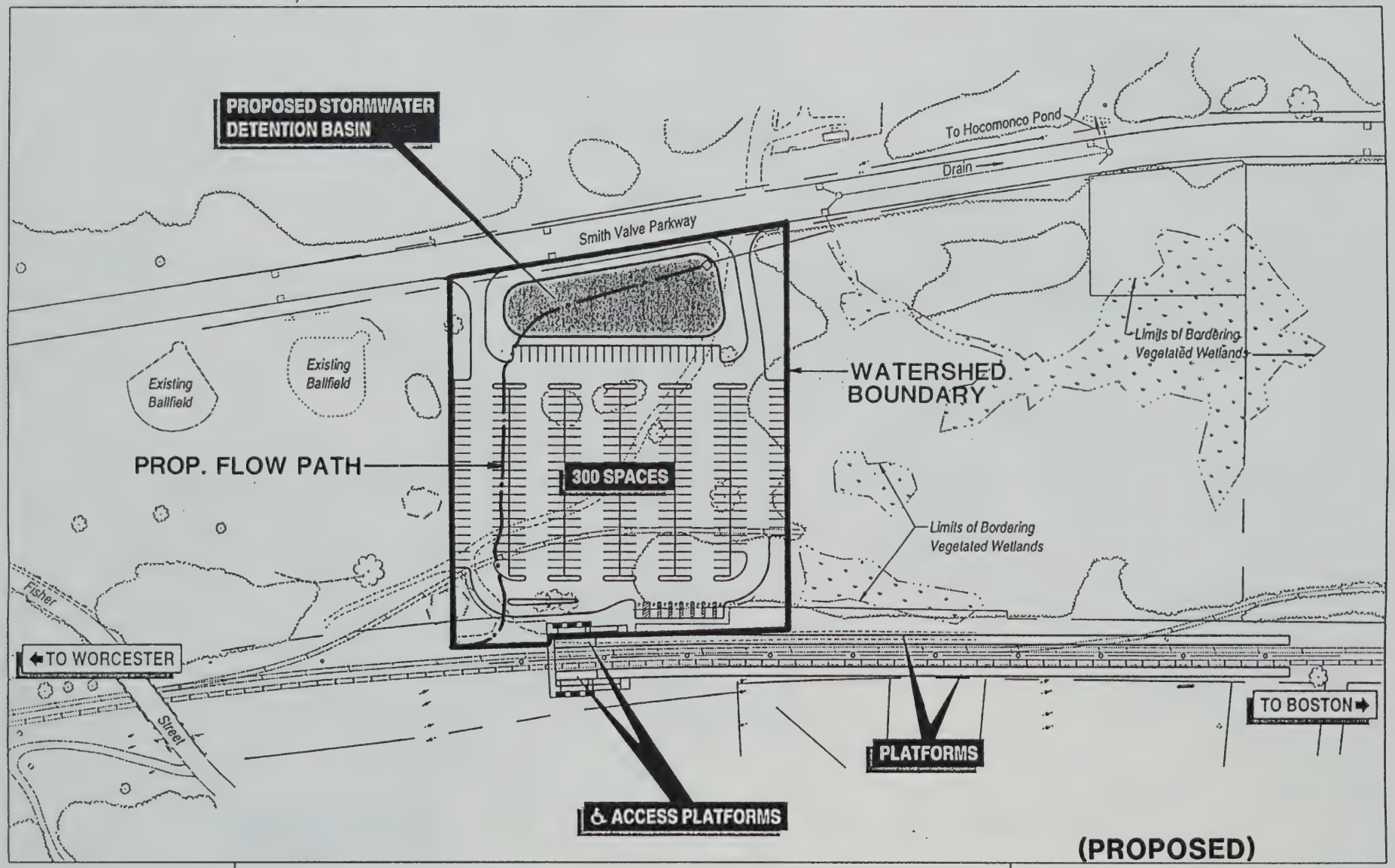
(EXISTING)

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 150'
0 150'

WATERSHED PLAN
WESTBOROUGH, MA

FIGURE 5.3.D-1



(PROPOSED)

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 150'

0 150'

WATERSHED PLAN

WESTBOROUGH, MA

FIGURE 5.3.D-2

Table 5.3-11 Watershed Data - Existing Conditions Westborough Station
A = 3.6 AC
.5 AC Wooded, 3.1 AC Grassland/Range
HSG: "A"
L_1 = 50′, S=6% (sheet flow), H
L_2 = 710′, S=2% (shallow concentrated), U

From TR-55	CN = 47	
	TOC = .18 hrs = 11 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	.37 in	1.16 in
Unit Peak Discharge (cfs/acre/in)	.392	.717
Peak Discharge	1 cfs (.52)	3 cfs (2.99)

Table 5.3-12 Watershed Data - Proposed Conditions Westborough Station
A = 3.6 AC
2.6 AC Pavement, 1.0 AC Grassland/Range
HSG: "A"
L_1 = 50', S=2.2% (sheet flow), F
L_2 = 100', S=3.0% (shallow concentrated), P
L_3 = 250', (open channel), <V=3 fps assumed>
L_4 = 240', (open channel), <V=1 fps assumed>

From TR-55	CN = 84	
	TOC = .23 hrs = 14 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	2.82 in	4.67 in
Unit Peak Discharge (cfs/acre/in)	.848	.848
Peak Discharge	9 cfs (8.61)	14 cfs (14.25)

Detention Pond Parameters

This detention basin is designed with three horizontal to one vertical (3:1) sideslopes. The outlet device will be a concrete 25° V-notch weir. The inlet to the basin will include a rip rap apron to slow velocities and dissipate hydraulic energies. The discharge will tie into the existing Smith Valve Parkway drainage system which drains into Hocomonco Pond. The bottom and sides of the basin will be loamed and seeded.

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T WESTBORO STATION User: RLD Date: 07-05-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
		Acres (CN)			
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	3.1(49)	-	-	-
Woods	fair	.5(36)	-	-	-
Total Area (by Hydrologic Soil Group)		3.6			

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.6 Acres WEIGHTED CURVE NUMBER:47*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T WESTBORO STATION User: RLD Date: 07-05-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.06	F					0.091
Shallow Concent'd		710	.02	U					0.086
								Time of Concentration =	0.18*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T WESTBORO STATION User: RLD Date: 07-05-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
		Acres (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		2.6(98)	-	-	-
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	1.0(49)	-	-	-
Total Area (by Hydrologic Soil Group)		3.6			

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.6 Acres WEIGHTED CURVE NUMBER:84*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T WESTBORO STATION User: RLD Date: 07-05-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.022	F					0.136
Shallow Concent'd		100	.03	P					0.008
Open Channel		250						3	0.023
Open Channel		240						1	0.067
								Time of Concentration =	0.23*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

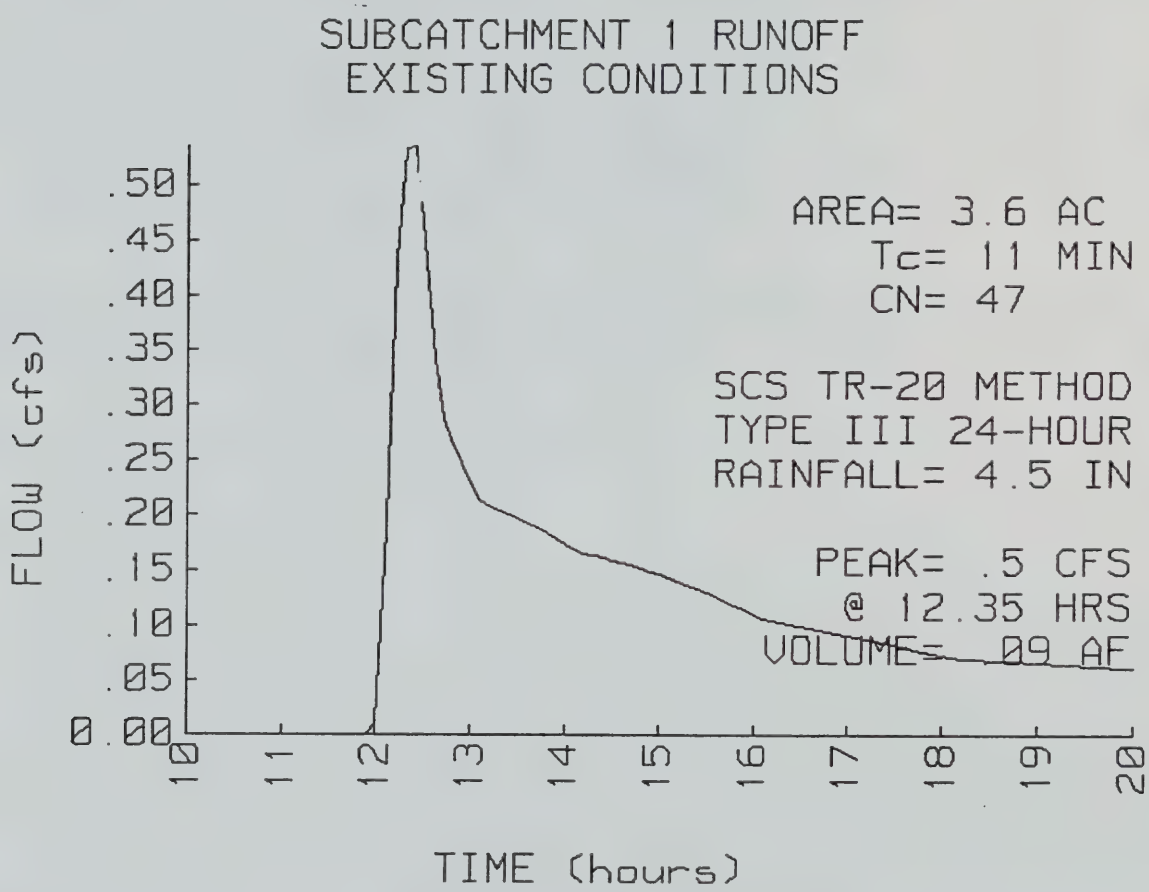
SUBCATCHMENT 1 **EXISTING CONDITIONS** 10 YEAR STORM

ACRES	CN
3.60	47

WEIGHTED CN FROM TR-55

AREA= 3.60 AC Tc= 11 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= .5 CFS @ 12.35 HRS
VOLUME= .09 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= .5 CFS @ 12.35 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.00	0.0	.2	.4	.5	.5	.5	.3	.3	.3	.2
13.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
14.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.1
15.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
16.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
17.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

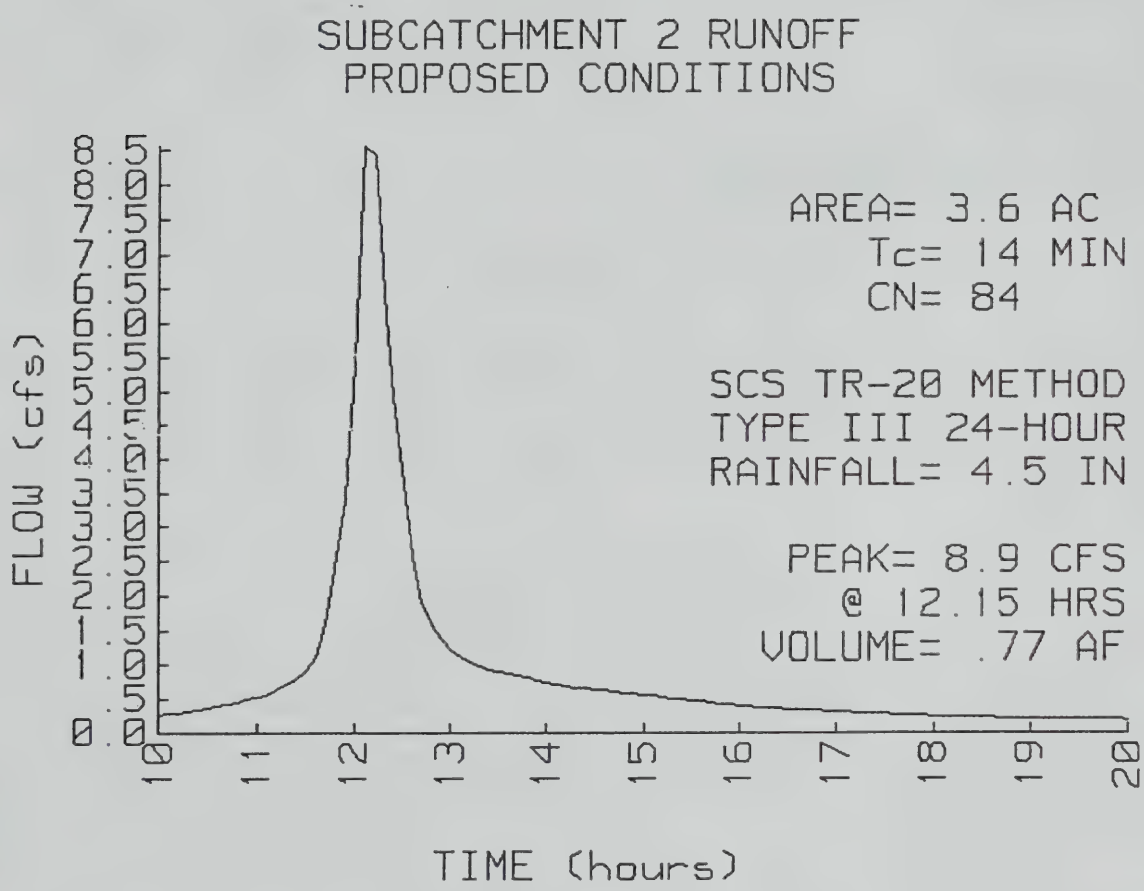
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 10 YEAR STORM

ACRES	CN
3.60	84

WEIGHTED CN FROM TR-55

AREA= 3.60 AC Tc= 14 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 8.9 CFS @ 12.15 HRS
VOLUME= .77 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 8.9 CFS @ 12.15 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	[illegible]	.3	.3	.3	.3	.4	.4	.4	.5	.5
11.00	.5	.6	.6	.7	.8	.9	1.1	1.6	2.4	3.4
12.00	5.4	8.6	8.4	6.4	4.9	3.6	2.6	1.9	1.6	1.4
13.00	1.2	1.1	1.0	1.0	.9	.9	.9	.8	.8	.8
14.00	.7	.7	.7	.7	.7	.6	.6	.6	.6	.6
15.00	.6	.5	.5	.5	.5	.5	.5	.4	.4	.4
16.00	.4	.4	.4	.4	.4	.4	.3	.3	.3	.3
17.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

POND 2 **DETENTION BASIN** 10 YEAR STORM

STARTING ELEV= 299.8 FT
FLOOD ELEV= 303.0 FT

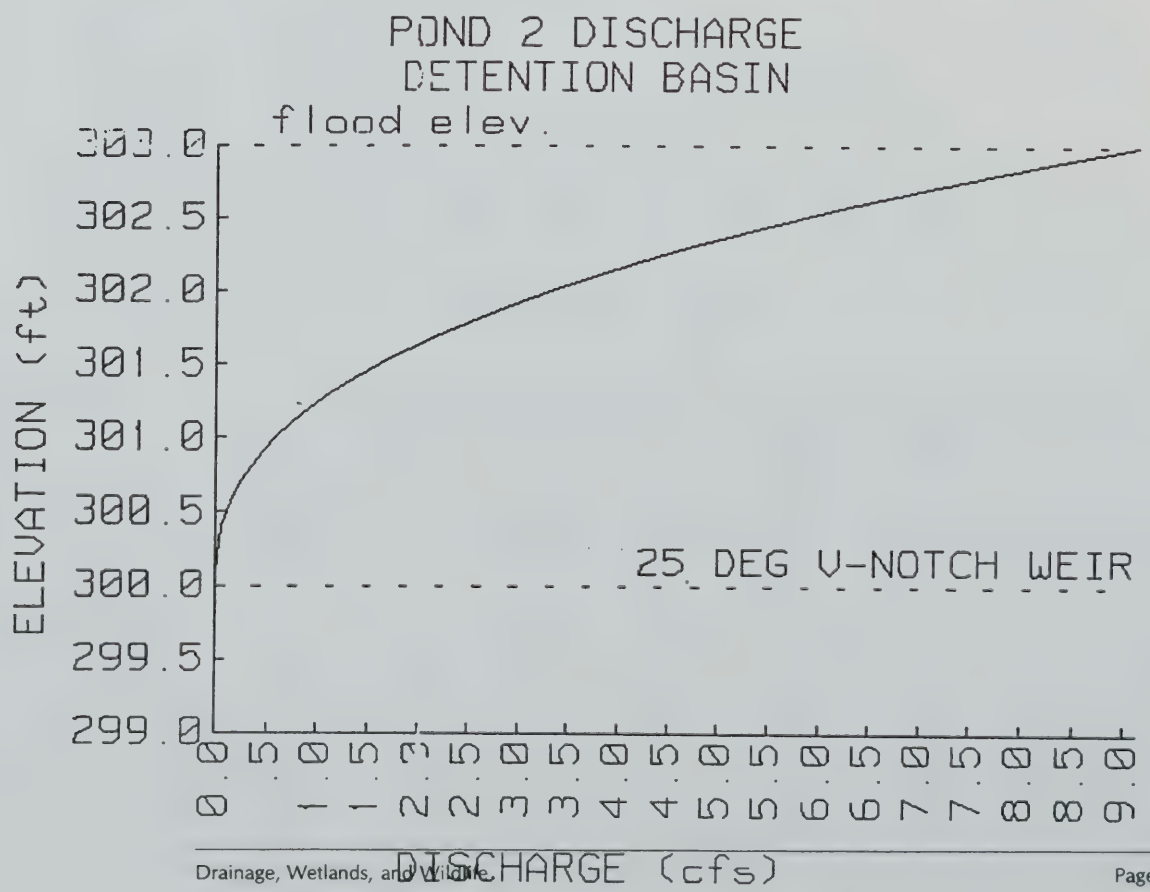
ELEVATION (FT)	CUM.STOR (AF)
299.0	0.00
299.5	.18
300.0	.57
301.0	.97
302.0	1.40
303.0	1.85

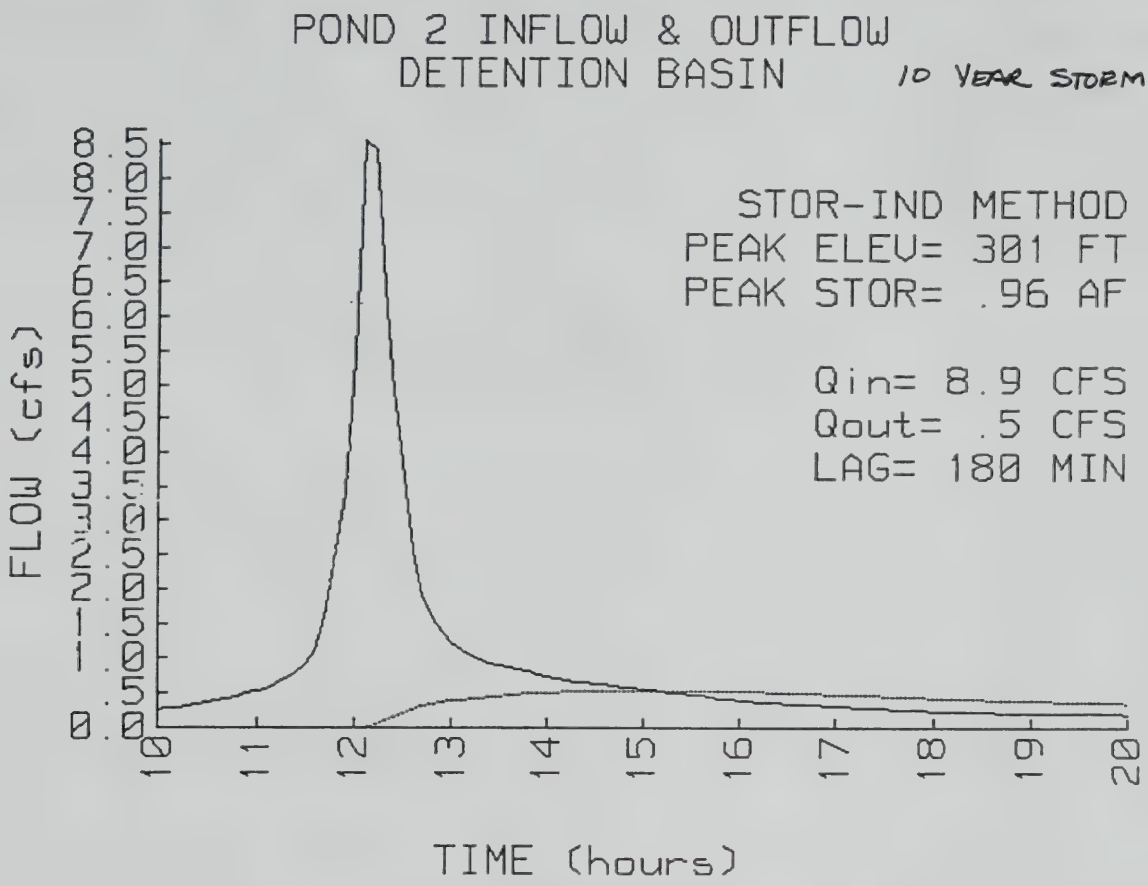
STOR-IND METHOD
PEAK ELEVATION= 301.0 FT
PEAK STORAGE = .96 AF
Qin = 8.9 CFS @ 12.15 HRS
Qout= .5 CFS @ 15.15 HRS
ATTEN= 94 % LAG= 180.0 MIN
IN/OUT= .77 / .29 AF

INVERT (FT)	OUTLET DEVICES
300.0	**25 DEG V-NOTCH WEIR**
	Q=2.64 TAN(Theta/2) H^2.5

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
299.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
300.0	0.0	0.0	0.0	0.0	.1	.1	.2	.2	.3	.4
301.0	.6	.7	.9	1.1	1.4	1.6	1.9	2.2	2.5	2.9
302.0	3.3	3.7	4.2	4.7	5.2	5.8	6.4	7.0	7.7	8.4
303.0	9.1									





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= .5 CFS @ 15.15 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.00	0.0	0.0	0.0	.1	.2	.2	.3	.3	.3	.4
13.00	.4	.4	.4	.4	.4	.5	.5	.5	.5	.5
14.00	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
15.00	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
16.00	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
17.00	.5	.5	.5	.5	.5	.5	.5	.4	.4	.4
18.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
19.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
20.00	.4									

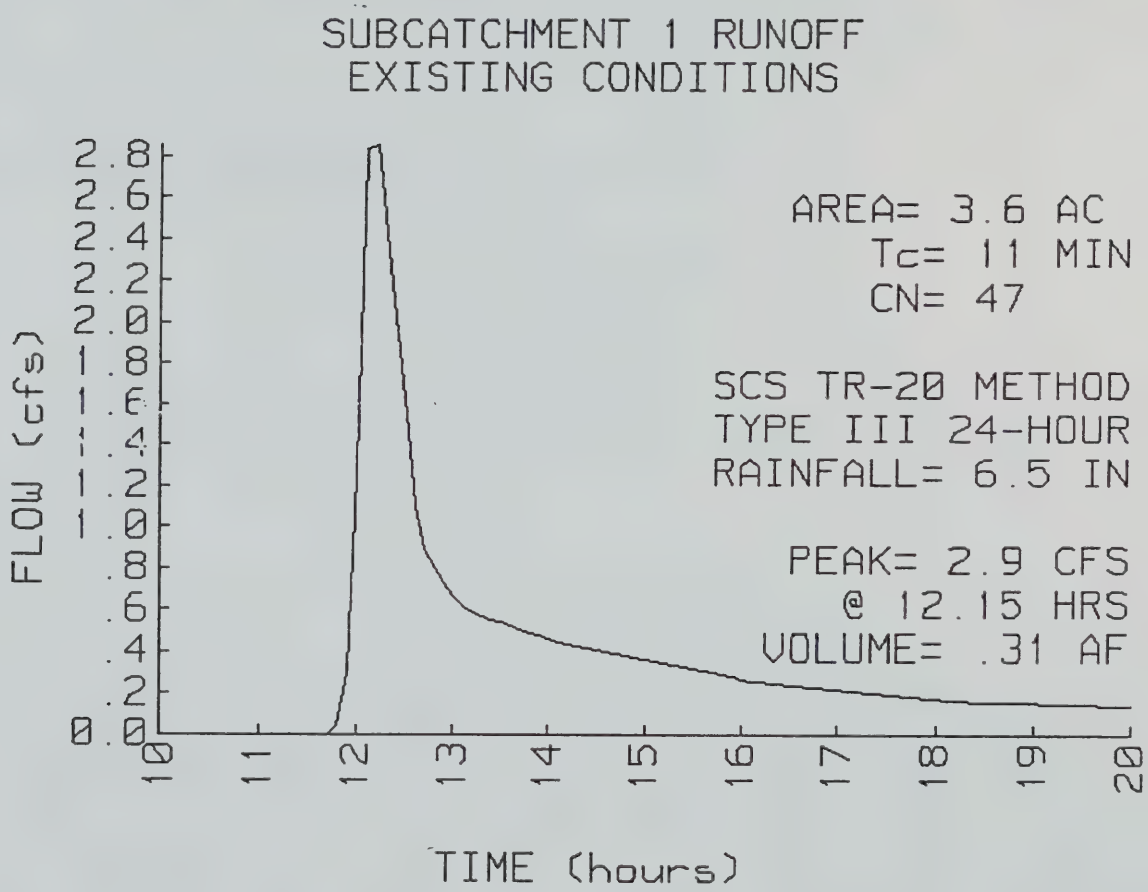
SUBCATCHMENT 1 **EXISTING CONDITIONS** 100 YEAR STORM

ACRES	CN
3.60	47

WEIGHTED CN FROM TR-55

AREA= 3.60 AC Tc= 11 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 2.9 CFS @ 12.15 HRS
VOLUME= .31 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 2.9 CFS @ 12.15 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.3
12.00	1.3	2.8	2.9	2.4	2.0	1.5	1.1	.9	.8	.7
13.00	.7	.6	.6	.6	.6	.5	.5	.5	.5	.5
14.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
15.00	.4	.4	.3	.3	.3	.3	.3	.3	.3	.3
16.00	.3	.3	.3	.2	.2	.2	.2	.2	.2	.2
17.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.1	.1	.1	.1	.1	.1
20.00	.1									

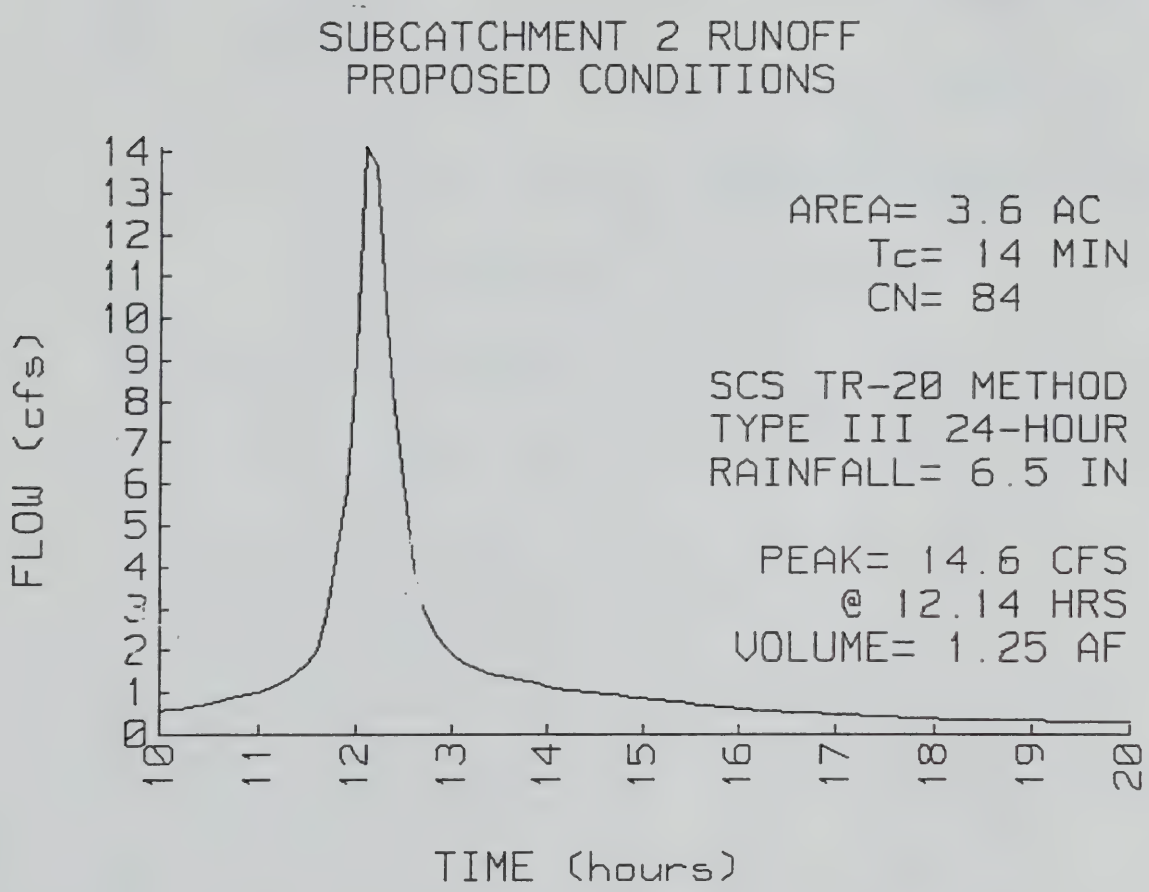
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 100 YEAR STORM

ACRES	CN
3.60	84

WEIGHTED CN FROM TR-55

AREA= 3.60 AC Tc= 14 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 14.6 CFS @ 12.14 HRS
VOLUME= 1.25 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 14.6 CFS @ 12.14 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.6	.6	.6	.7	.7	.8	.8	.8	.9	1.0
11.00	1.0	1.1	1.2	1.3	1.5	1.7	2.0	2.9	4.2	5.9
12.00	9.1	14.1	13.6	10.3	7.8	5.7	4.0	3.0	2.4	2.1
13.00	1.9	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
14.00	1.2	1.1	1.1	1.0	1.0	1.0	1.0	.9	.9	.9
15.00	.9	.8	.8	.8	.8	.7	.7	.7	.7	.6
16.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.5
17.00	.5	.5	.5	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.4	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

POND 2 **DETENTION BASIN** 100 YEAR STORM

STARTING ELEV= 299.8 FT
FLOOD ELEV= 303.0 FT

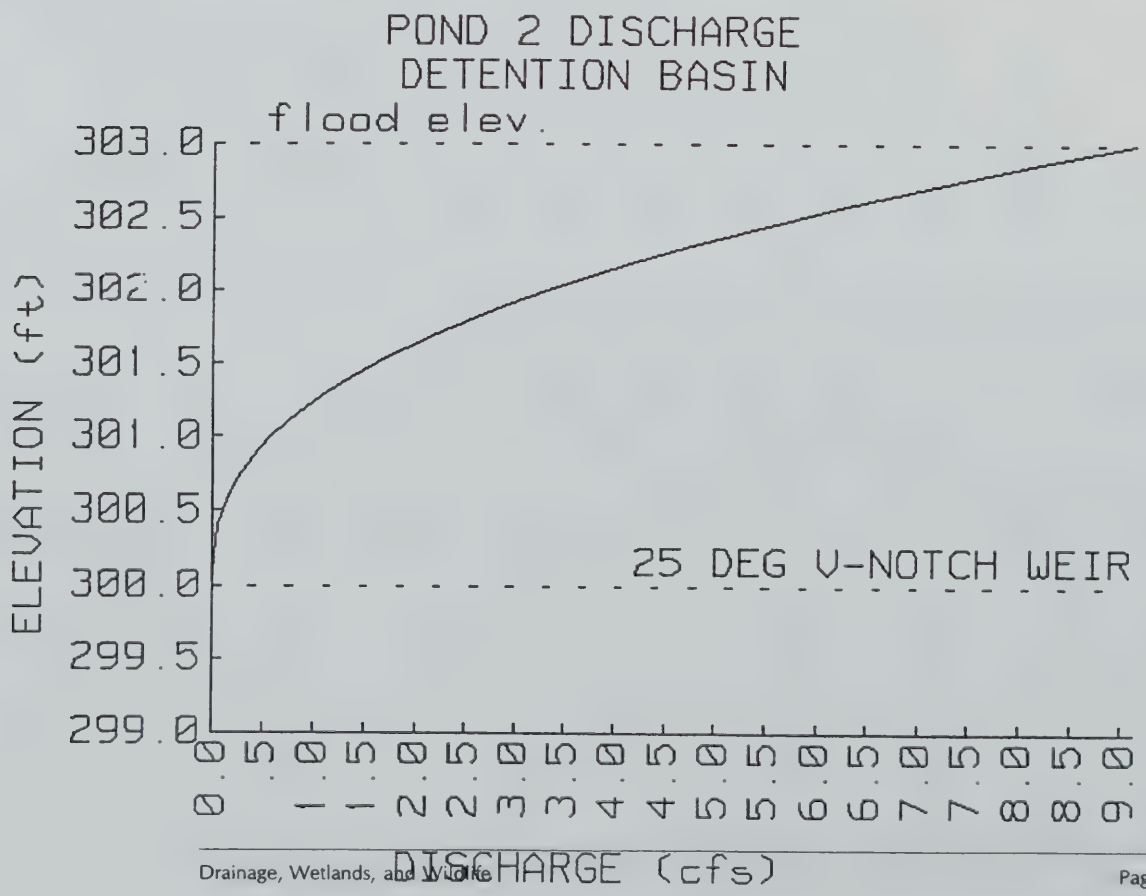
ELEVATION (FT)	CUM.STOR (AF)
299.0	0.00
299.5	.18
300.0	.57
301.0	.97
302.0	1.40
303.0	1.85

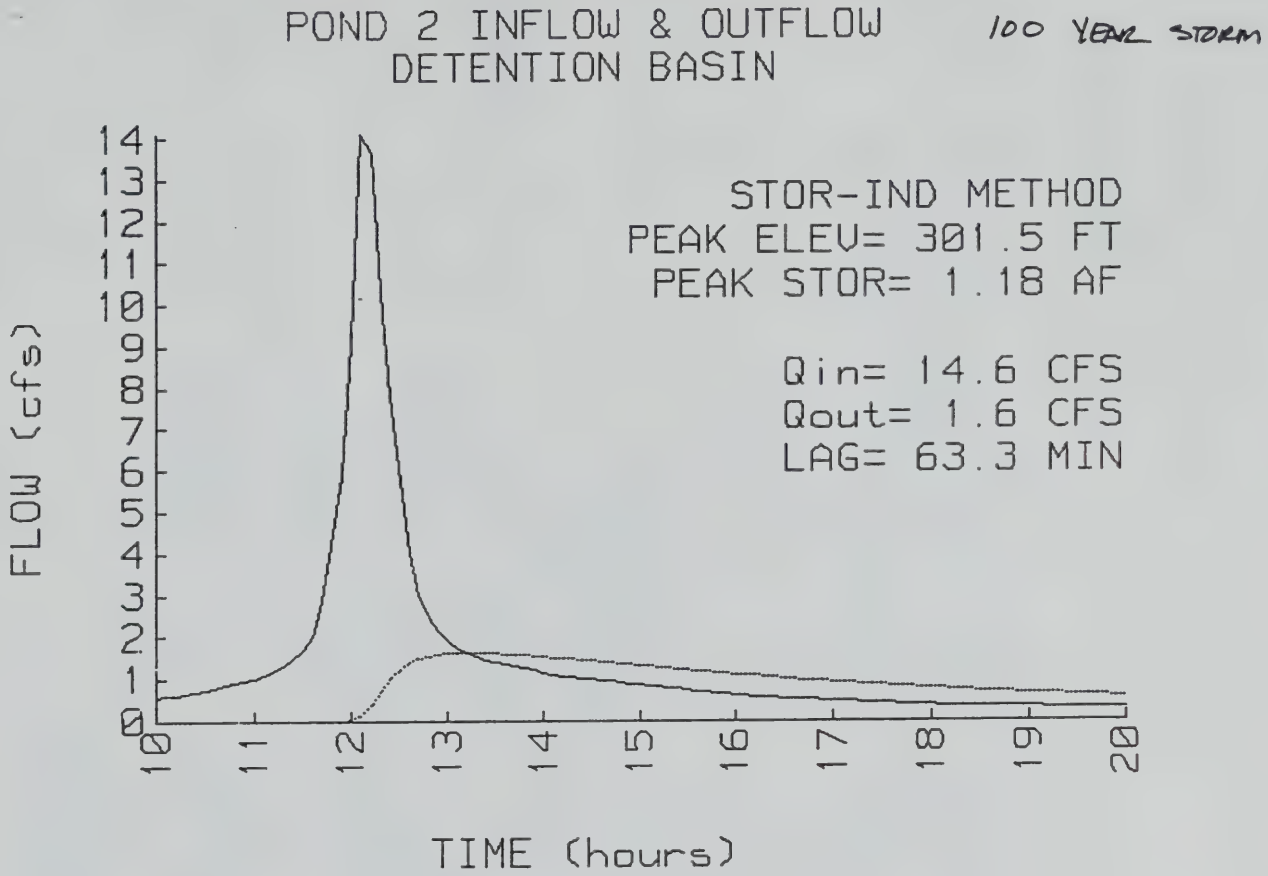
STOR-IND METHOD
PEAK ELEVATION= 301.5 FT
PEAK STORAGE = 1.18 AF
Qin = 14.6 CFS @ 12.14 HRS
Qout= 1.6 CFS @ 13.20 HRS
ATTEN= 89 % LAG= 63.3 MIN
IN/OUT= 1.25 / .70 AF

INVERT (FT)	OUTLET DEVICES
300.0	**25 DEG V-NOTCH WEIR**
	Q=2.64 TAN(Theta/2) H^2.5

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
299.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
300.0	0.0	0.0	0.0	0.0	.1	.1	.2	.2	.3	.4
301.0	.6	.7	.9	1.1	1.4	1.6	1.9	2.2	2.5	2.9
302.0	3.3	3.7	4.2	4.7	5.2	5.8	6.4	7.0	7.7	8.4
303.0	9.1									





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= 1.6 CFS @ 13.20 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.00	0.0	.1	.4	.7	1.0	1.2	1.4	1.5	1.5	1.6
13.00	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5
14.00	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.3
15.00	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.1
16.00	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	.9
17.00	.9	.9	.9	.9	.9	.8	.8	.8	.8	.8
18.00	.8	.8	.7	.7	.7	.7	.7	.7	.7	.7
19.00	.7	.6	.6	.6	.6	.6	.6	.6	.6	.6
20.00	.6									

5.3.E Southborough Station

Objective

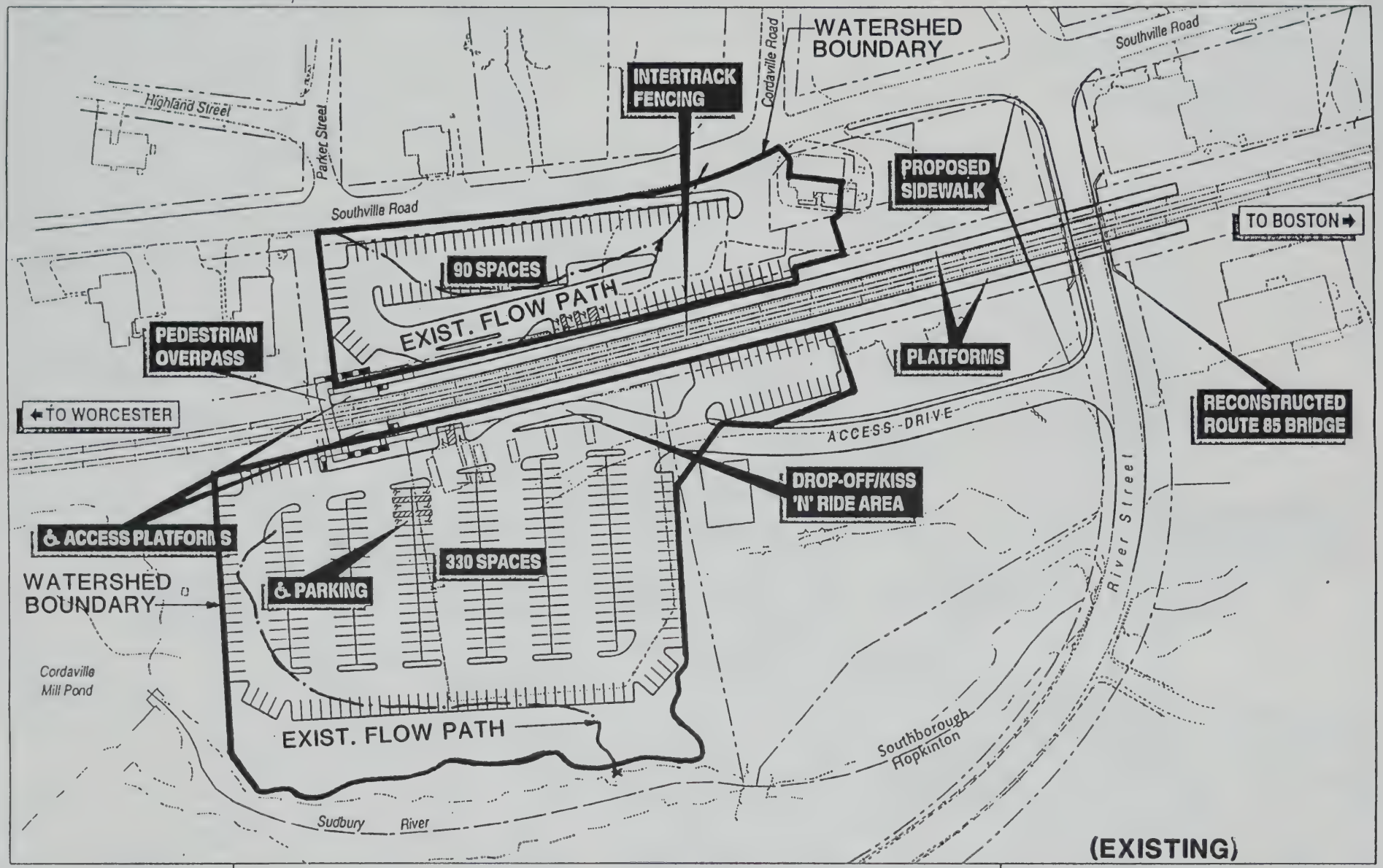
To avoid an increase to the peak flow rate of the Sudbury River due to proposed construction.

Assumptions and Methodologies

The design storm has been modelled as a Type III storm in Worcester County. This results with a 4.5 in. and 6.5 in. 24 hour rainfall for the 10 year and 100 year design storm, respectively. The site drainage area is assumed to be a combination of packed gravel parking and grassland/range areas in the existing condition. The ultimate discharge point is the Sudbury River. The peak flow rate of the river is assumed to occur much later than the peak flow emanating from the station site runoff. By discharging directly to the river without detention the chances of the two peaks occurring at the same time has been avoided.

Conclusions

Peak rates and volumes have been increased within the subwatersheds of the parking areas. However, the impact on the entire water shed of the Sudbury River will be negligible given the assumption that the peak for the entire water shed occurs much later.

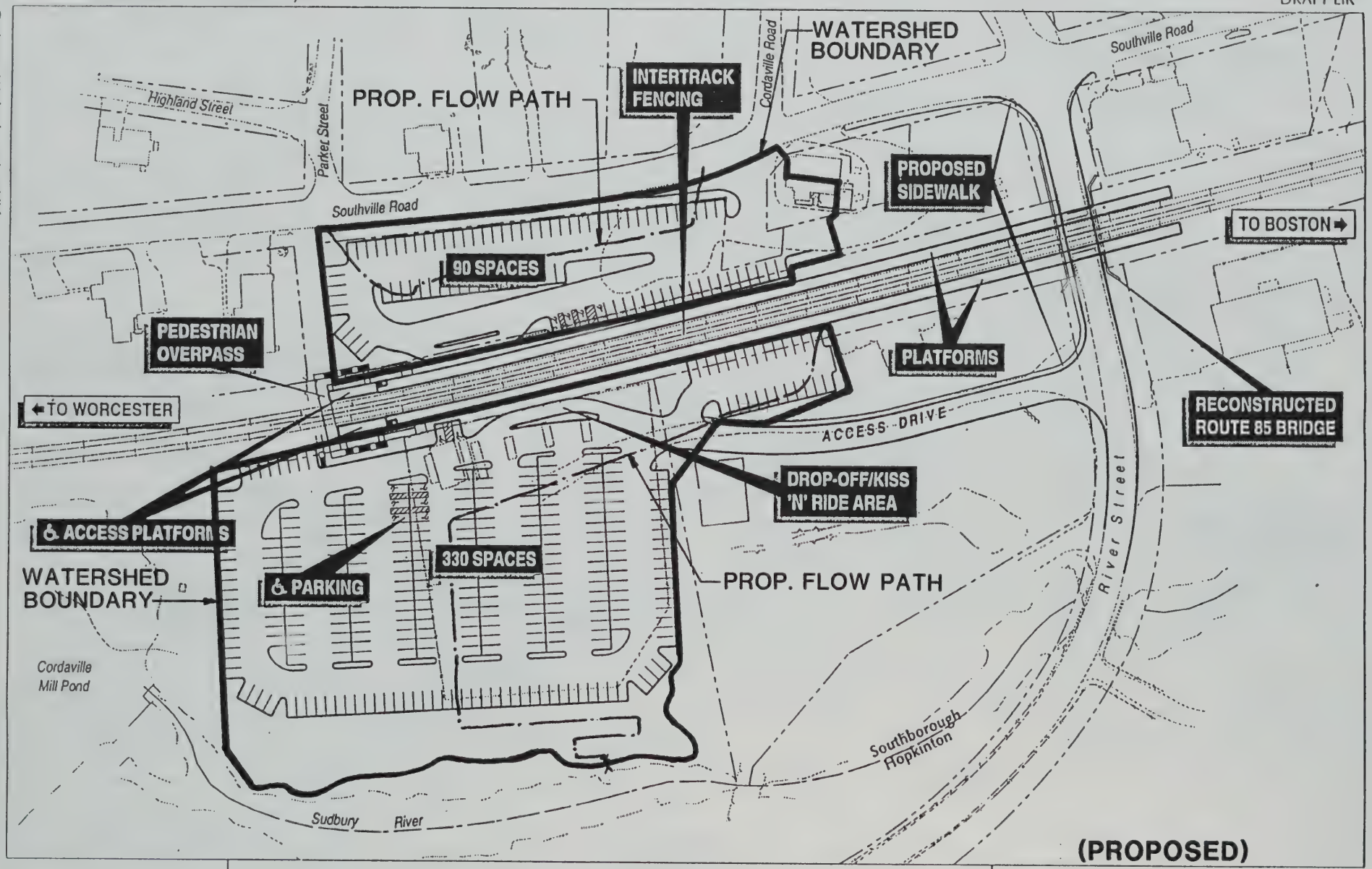


Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

WATERSHED PLAN
SOUTHBOROUGH STATION

FIGURE 5.3.E-1



(PROPOSED)

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

WATERSHED PLAN
SOUTHBOROUGH STATION

FIGURE 5.3.E-2

Table 5.3-13 Watershed Data - Existing Conditions - North Lot Southborough Station
A = 1.3 AC
.04 AC Pavement, .34 AC Packed Gravel, .92 Grassland/Range
HSG: "B"
L_1 = 50′, S=16% (sheet flow), F
L_2 = 50′, S=2% (shallow concentrated), F
L_3 = 320′, S=1% (shallow concentrated), U

From TR-55	CN = 74	
	TOC = .22 hrs = 13 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	1.97 in	3.61 in
Unit Peak Discharge (cfs/acre/in)	.814	.854
Peak Discharge	2 cfs (2.08)	4 cfs (4.01)

Table 5.3-14 Watershed Data - Proposed Conditions - North Lot Southborough Station
A = 1.3 AC
1.12 AC Pavement, .18 AC Grass
HSG: "B"
L_1 = 40′, S=16% (sheet flow), F
L_2 = 70′, S=2% (shallow concentrated), P
L_3 = 320′, (open channel), <V=3 fps assumed>

From TR-55	CN = 94	
	TOC = .09 hrs = 5 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	3.82 in	5.79 in
Unit Peak Discharge (cfs/acre/in)	1.053	1.053
Peak Discharge	5 cfs (5.23)	8 cfs (7.92)

Table 5.3-15 Watershed Data - Existing Conditions - South Lot Southborough Station
A = 3.5 AC
20% Treed, 40% Packed Gravel, 40% Grassland/Range
HSG: "B" (Udorthents - Drained Sands and Gravels)
L_1 = 50′, S=6% (sheet flow), F
L_2 = 440′, S=3% (shallow concentrated), U

From TR-55	CN = 74	
	TOC = .13 hrs = 8 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	2.0 in	3.6 in
Unit Peak Discharge (cfs/acre/in)	.951	.978
Peak Discharge	7 cfs (6.56)	12 cfs (12.36)

Table 5.3-16 Watershed Data - Proposed Conditions - South Lot Southborough Station
A = 3.5 AC
85% Pavement = 3.0 AC, .5 AC Treed
HSG: "B"
L_1 = 50′, S=2% (sheet)
L_2 = 80′, S=2% (shallow concentrated), P
L_3 = 470′, (open channel) <V=3 fps assumed> pipe flow
L_4 = 300′, S=.5% <V=1 fps diversion swale>

From TR-55	CN = 93	
	TOC = .15 hrs = 9 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	3.7 in	5.7 in
Unit Peak Discharge (cfs/acre/in)	.951	.951
Peak Discharge	12 cfs (12.35)	19 cfs (18.91)

Diversion Swales and Stilling Basin Parameters

Grassed swales and riprap stilling basins will be incorporated to dissipate hydraulic energies and enhance water quality benefits. The swales will provide a longitudinal slope of .005 ft./ft. and a 2′ depth of flow. The channel bottom will be 3′ wide with 2:1 side slopes loamed and seeded with an erosion resistant reed canary grass. A Mannings "n" of .03 yields a flow velocity of approximately 1 fps. This allows additional contact time in the swale which aids in filtration and purification impacts. Stilling basins will help to contain sediment loads thereby limiting turbidity at the discharge. A minimum 8" diameter rip rap will be used in an 18" thick layer covering the bottom of the basin. A 12" deep pool will be constructed to capture sediment and settleable pollutants.

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORC. T SOUTHBORO STA (NORTH) User: RLD Date: 07-01-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Impervious Areas				
Paved parking lots, roofs, driveways	-	.04(98)	-	-
Streets and roads				
Gravel (w/ right-of-way)	-	.34(85)	-	-
OTHER AGRICULTURAL LANDS				
Pasture, grassland or range fair	-	.92(69)	-	-
Total Area (by Hydrologic Soil Group)		1.3		

SUBAREA: ONE TOTAL DRAINAGE AREA: 1.3 Acres WEIGHTED CURVE NUMBER:74*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORC. T SOUTHBORO STA (NORTH) User: RLD Date: 07-01-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.16	F					0.061
Sheet		50	.04	F					0.107
Shallow Concent'd		320	.01	U					0.055
								Time of Concentration =	0.22*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORC. T SOUTHBORO STA (NORTH) User: RLD Date: 07-05-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		-	1.12(98)	-	-
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	-	.18(69)	-	-
Total Area (by Hydrologic Soil Group)			1.3		

SUBAREA: ONE TOTAL DRAINAGE AREA: 1.3 Acres WEIGHTED CURVE NUMBER:94*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORC. T SOUTHBORO STA (NORTH) User: RLD Date: 07-05-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	40	.16	F					0.051
Shallow Concent'd		70	.02	P					0.007
Open Channel		320						3	0.030
								Time of Concentration =	0.09*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

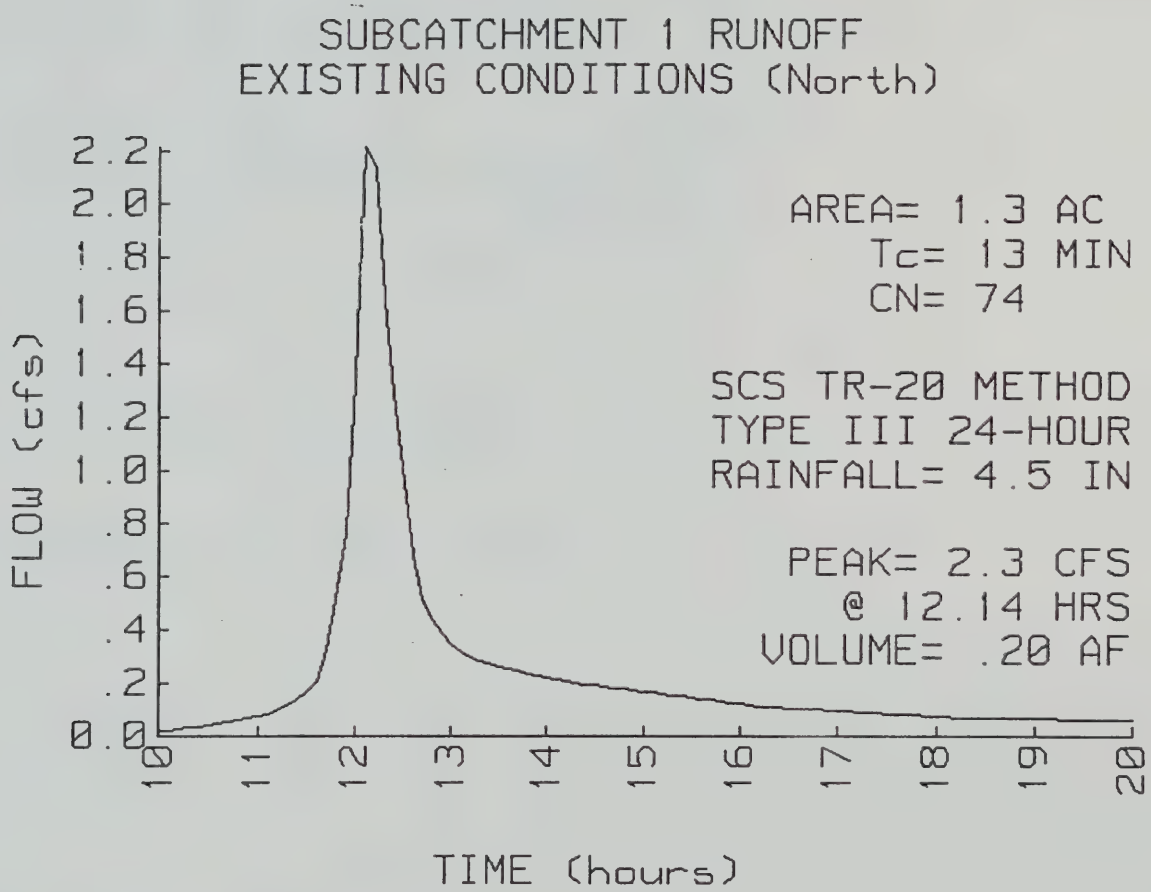
SUBCATCHMENT 1 **EXISTING CONDITIONS (North)** 10 YR STORM

ACRES	CN
1.30	74

WEIGHTED CN FROM TR-55

AREA= 1.30 AC Tc= 13 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 2.3 CFS @ 12.14 HRS
VOLUME= .20 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS (North)**

RUNOFF PEAK= 2.3 CFS @ 12.14 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.1
11.00	.1	.1	.1	.1	.1	.2	.2	.3	.5	.8
12.00	1.3	2.2	2.1	1.6	1.3	1.0	.7	.5	.4	.4
13.00	.3	.3	.3	.3	.3	.3	.3	.2	.2	.2
14.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
15.00	.2	.2	.2	.2	.1	.1	.1	.1	.1	.1
16.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
17.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

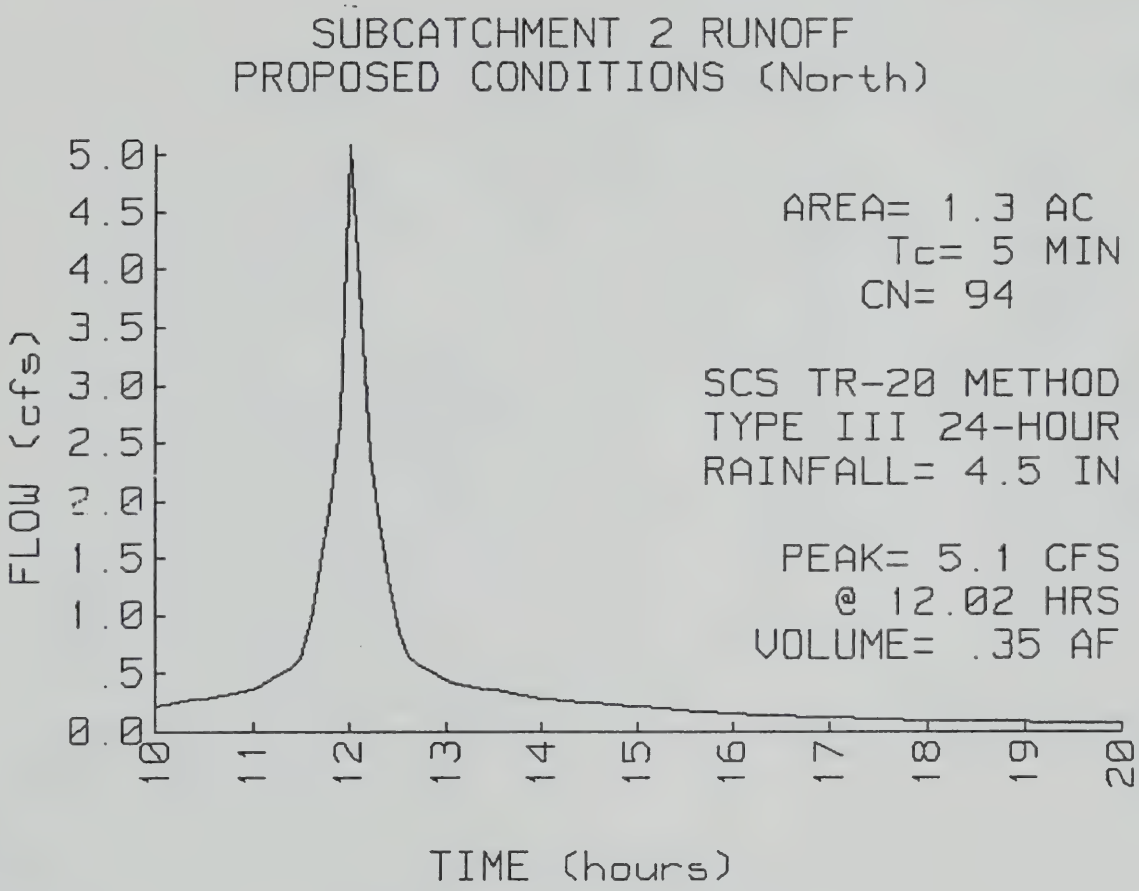
SUBCATCHMENT 2 **PROPOSED CONDITIONS (North)** 10 YEAR STORM

ACRES	CN
1.30	94

WEIGHTED CN FROM TR-55

AREA= 1.30 AC Tc= 5 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 5.1 CFS @ 12.02 HRS
VOLUME= .35 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS (North)**

RUNOFF PEAK= 5.1 CFS @ 12.02 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.2	.2	.2	.3	.3	.3	.3	.3	.3	.3
11.00	.4	.4	.5	.5	.6	.6	1.0	1.4	1.9	2.7
12.00	5.1	3.9	2.4	1.8	1.3	.9	.7	.6	.5	.5
13.00	.4	.4	.4	.4	.4	.4	.3	.3	.3	.3
14.00	.3	.3	.3	.3	.3	.3	.2	.2	.2	.2
15.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
16.00	.2	.1	.1	.1	.1	.1	.1	.1	.1	.1
17.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

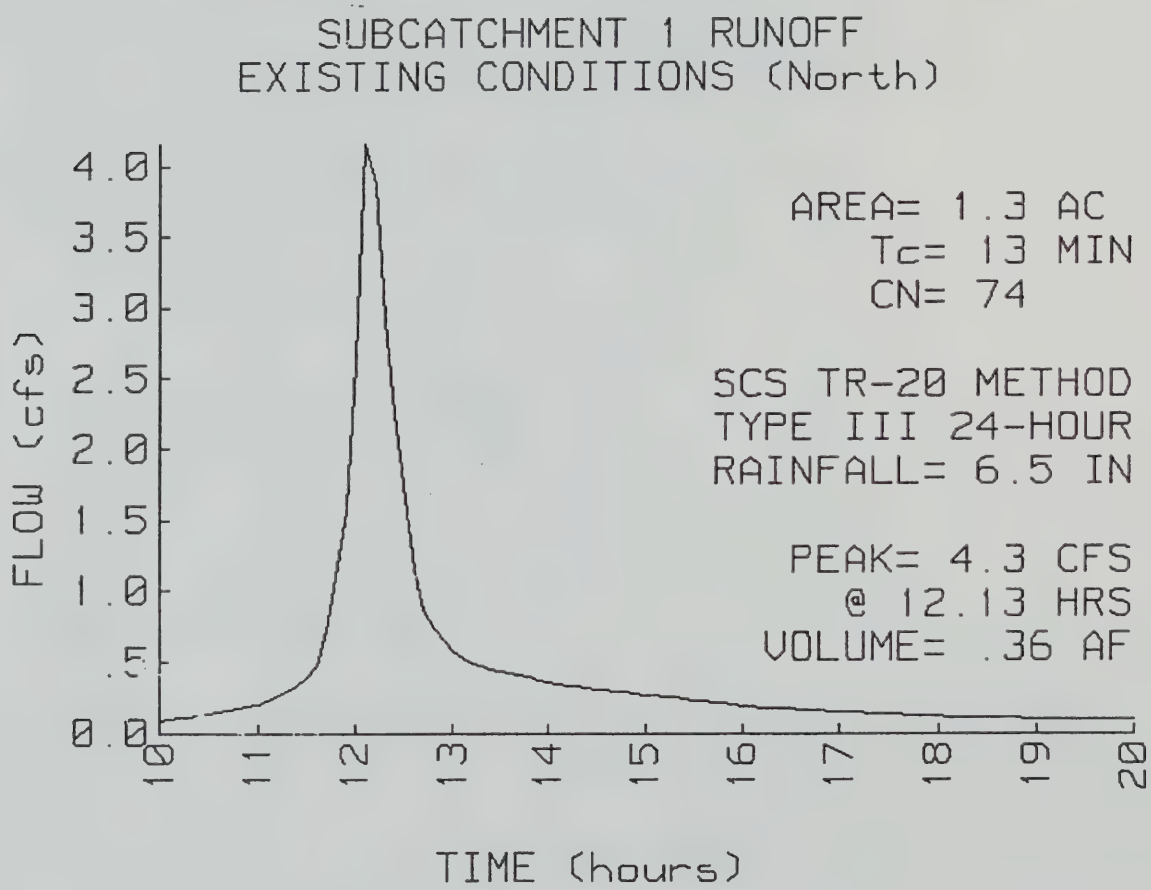
SUBCATCHMENT 1 **EXISTING CONDITIONS (North)** 100 YEAR STORM

ACRES	CN
1.30	74

WEIGHTED CN FROM TR-55

AREA= 1.30 AC Tc= 13 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 4.3 CFS @ 12.13 HRS
VOLUME= .36 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS (North)**

RUNOFF PEAK= 4.3 CFS @ 12.13 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.1	.1	.1	.1	.1	.1	.2	.2	.2	.2
11.00	.2	.2	.3	.3	.3	.4	.5	.7	1.1	1.6
12.00	2.6	4.2	3.9	2.9	2.2	1.7	1.2	.9	.7	.7
13.00	.6	.5	.5	.5	.5	.4	.4	.4	.4	.4
14.00	.4	.3	.3	.3	.3	.3	.3	.3	.3	.3
15.00	.3	.3	.3	.3	.2	.2	.2	.2	.2	.2
16.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
17.00	.2	.2	.1	.1	.1	.1	.1	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

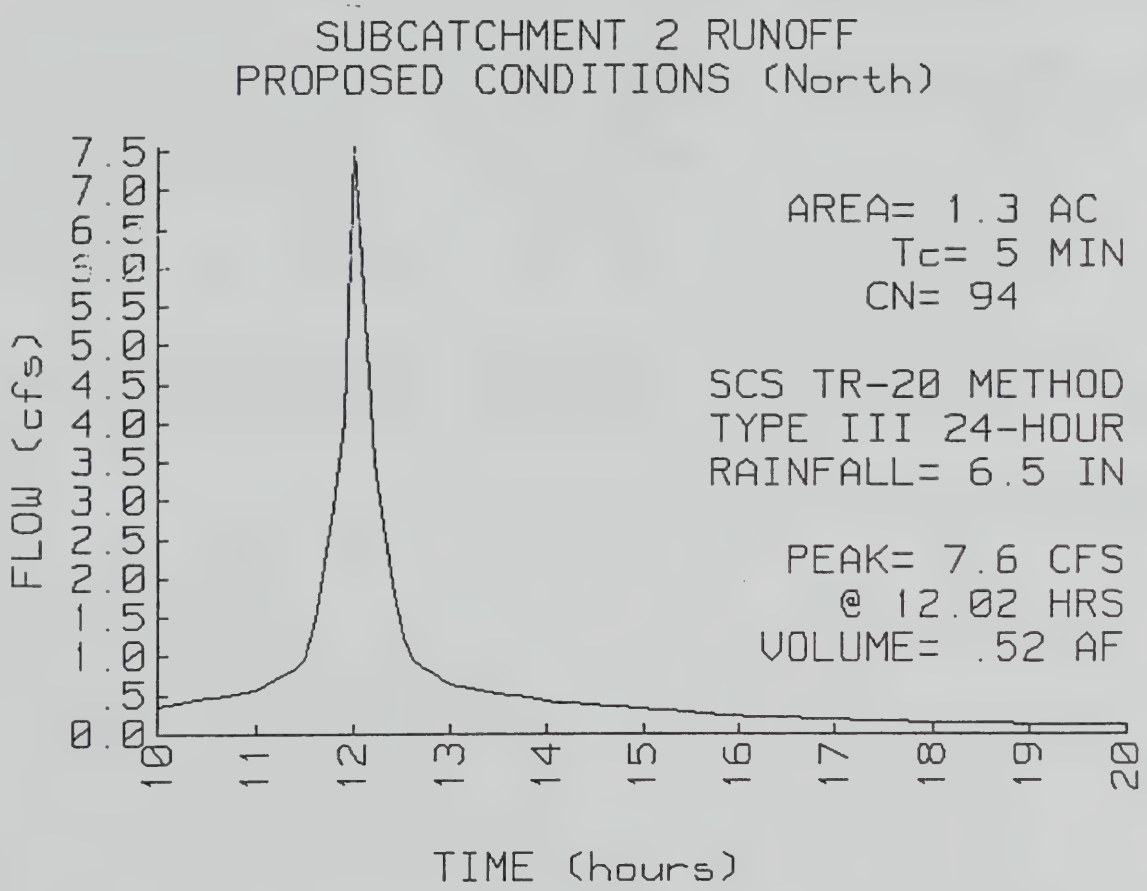
SUBCATCHMENT 2 **PROPOSED CONDITIONS (North)** 100 YEAR STORM

ACRES	CN
1.30	94

WEIGHTED CN FROM TR-55

AREA= 1.30 AC Tc= 5 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 7.6 CFS @ 12.02 HRS
VOLUME= .52 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS (North)**

RUNOFF PEAK= 7.6 CFS @ 12.02 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.4	.4	.4	.4	.4	.5	.5	.5	.5	.5
11.00	.6	.6	.7	.8	.8	1.0	1.5	2.2	2.9	4.0
12.00	7.6	5.7	3.5	2.7	1.9	1.2	1.0	.9	.8	.7
13.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.4
14.00	.4	.4	.4	.4	.4	.4	.4	.3	.3	.3
15.00	.3	.3	.3	.3	.3	.3	.3	.3	.2	.2
16.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
17.00	.2	.2	.2	.2	.2	.2	.2	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T SOUTHBORO STATION (SOUTH) User: RLD Date: 07-01-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Streets and roads					
Gravel (w/ right-of-way)		-	1.4(85)	-	-
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	fair	-	1.4(69)	-	-
Woods	fair	-	.70(60)	-	-
Total Area (by Hydrologic Soil Group)			3.5		

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.5 Acres WEIGHTED CURVE NUMBER:74*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T SOUTHBORO STATION (SOUTH) User: RLD Date: 07-01-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.06	F					0.091
Shallow Concent'd		440	.03	U					0.044
						Time of Concentration =			0.13*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORCESTER T SOUTHBORO STATION (SOUTH) User: RLD Date: 07-01-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		-	3.0(98)	-	-
OTHER AGRICULTURAL LANDS					
Woods	fair	-	.50(60)	-	-
Total Area (by Hydrologic Soil Group)			3.5		

SUBAREA: ONE TOTAL DRAINAGE AREA: 3.5 Acres WEIGHTED CURVE NUMBER:93*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORCESTER T SOUTHBORO STATION (SOUTH) User: RLD Date: 07-01-94
County : WORCESTER State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3	50	.02	A					0.012
Shallow Concent'd		80	.02	P					0.008
Open Channel		470						3	0.044
Open Channel		300						1	0.083
							Time of Concentration =		0.15*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

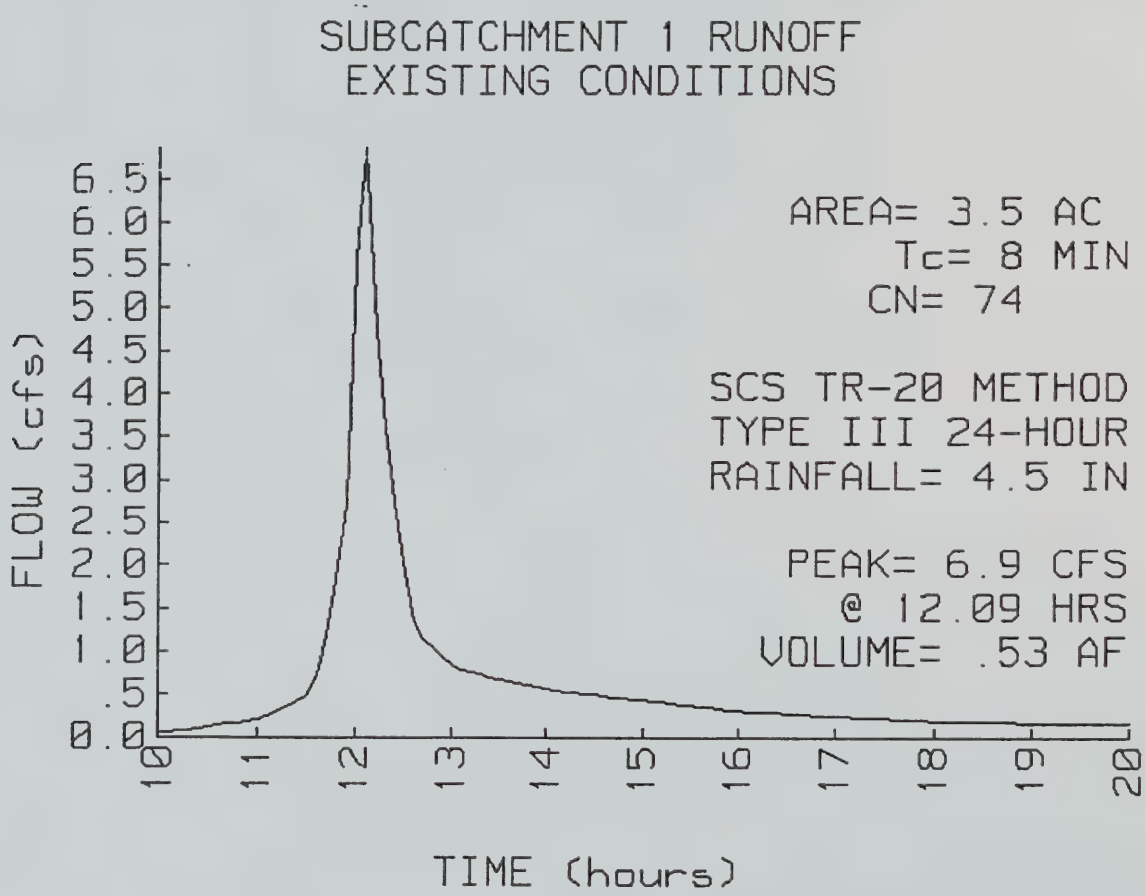
SUBCATCHMENT 1 **EXISTING CONDITIONS** 10 YEAR STORM

ACRES	CN
3.50	74

WEIGHTED CN FROM TR-55

AREA= 3.50 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 6.9 CFS @ 12.09 HRS
VOLUME= .53 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 6.9 CFS @ 12.09 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2
11.00	.2	.3	.3	.4	.4	.5	.7	1.2	1.8	2.7
12.00	5.5	6.9	4.7	3.6	2.7	1.9	1.3	1.1	1.0	.9
13.00	.9	.8	.8	.7	.7	.7	.7	.6	.6	.6
14.00	.6	.5	.5	.5	.5	.5	.5	.5	.5	.5
15.00	.4	.4	.4	.4	.4	.4	.4	.4	.3	.3
16.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
17.00	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

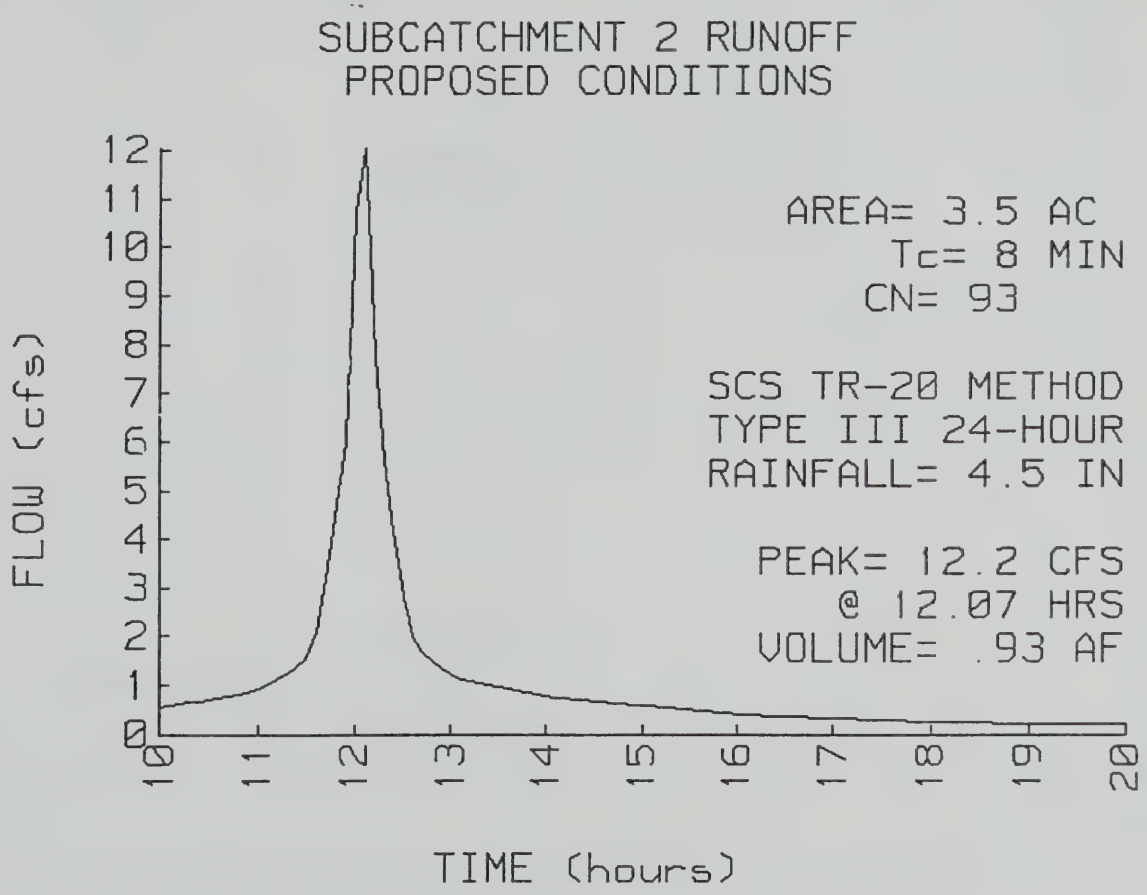
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 10 YEAR STORM

ACRES	CN
3.50	93

WEIGHTED CN FROM TR-55

AREA= 3.50 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 12.2 CFS @ 12.07 HRS
VOLUME= .93 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 12.2 CFS @ 12.07 HOURS

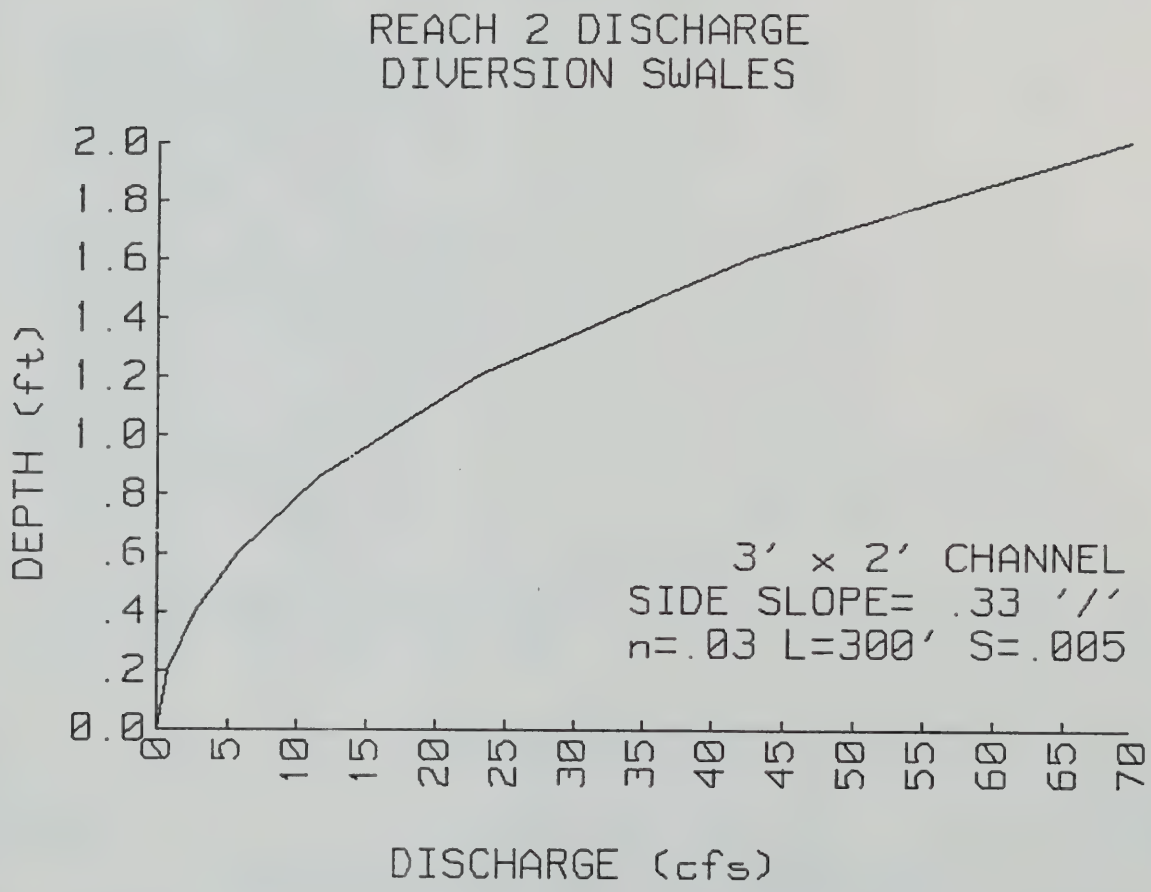
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.6	.6	.6	.6	.7	.7	.8	.8	.8	.9
11.00	.9	1.0	1.1	1.2	1.4	1.5	2.1	3.2	4.5	6.0
12.00	10.7	12.0	7.8	5.6	4.1	2.8	2.0	1.7	1.5	1.4
13.00	1.2	1.1	1.1	1.0	1.0	1.0	.9	.9	.9	.8
14.00	.8	.8	.7	.7	.7	.7	.7	.6	.6	.6
15.00	.6	.6	.6	.5	.5	.5	.5	.5	.5	.4
16.00	.4	.4	.4	.4	.4	.4	.4	.4	.3	.3
17.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
18.00	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

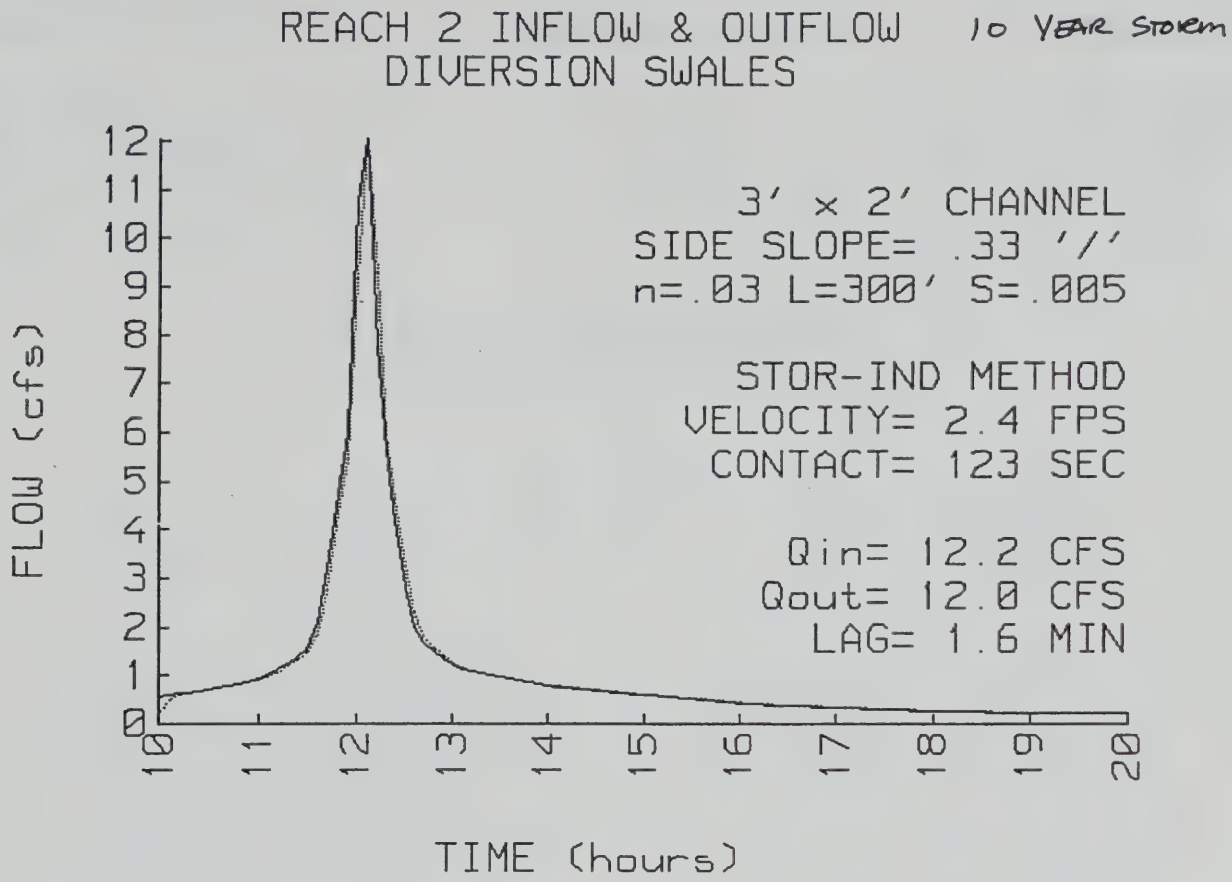
REACH 2 **DIVERSION SWALES** 10 YEAR STORM

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.0
.2	.7	.8
.4	1.7	2.7
.6	2.9	5.7
.9	4.8	11.6
1.2	8.0	23.0
1.6	12.6	42.5
2.0	18.1	69.6

3' x 2' CHANNEL
SIDE SLOPE= .33 '/'
n= .03
LENGTH= 300 FT
SLOPE= .005 FT/FT

STOR-IND METHOD
MAX. DEPTH= .87 FT
PEAK VELOCITY= 2.4 FPS
CONTACT TIME = 123 SEC
Qin = 12.2 CFS @ 12.07 HRS
Qout= 12.0 CFS @ 12.10 HRS
ATTEN= 2 % LAG= 1.6 MIN
IN/OUT= .93 / .93 AF





REACH 2 **DIVERSION SWALES**

OUTFLOW PEAK= 12.0 CFS @ 12.10 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.2	.5	.6	.6	.7	.7	.7	.8	.8	.9
11.00	.9	1.0	1.1	1.2	1.3	1.5	1.8	2.7	4.1	5.5
12.00	9.2	12.0	9.2	5.9	4.6	3.2	2.3	1.8	1.6	1.4
13.00	1.3	1.2	1.1	1.1	1.0	1.0	.9	.9	.9	.8
14.00	.8	.8	.7	.7	.7	.7	.7	.7	.6	.6
15.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.4
16.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.3
17.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
18.00	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

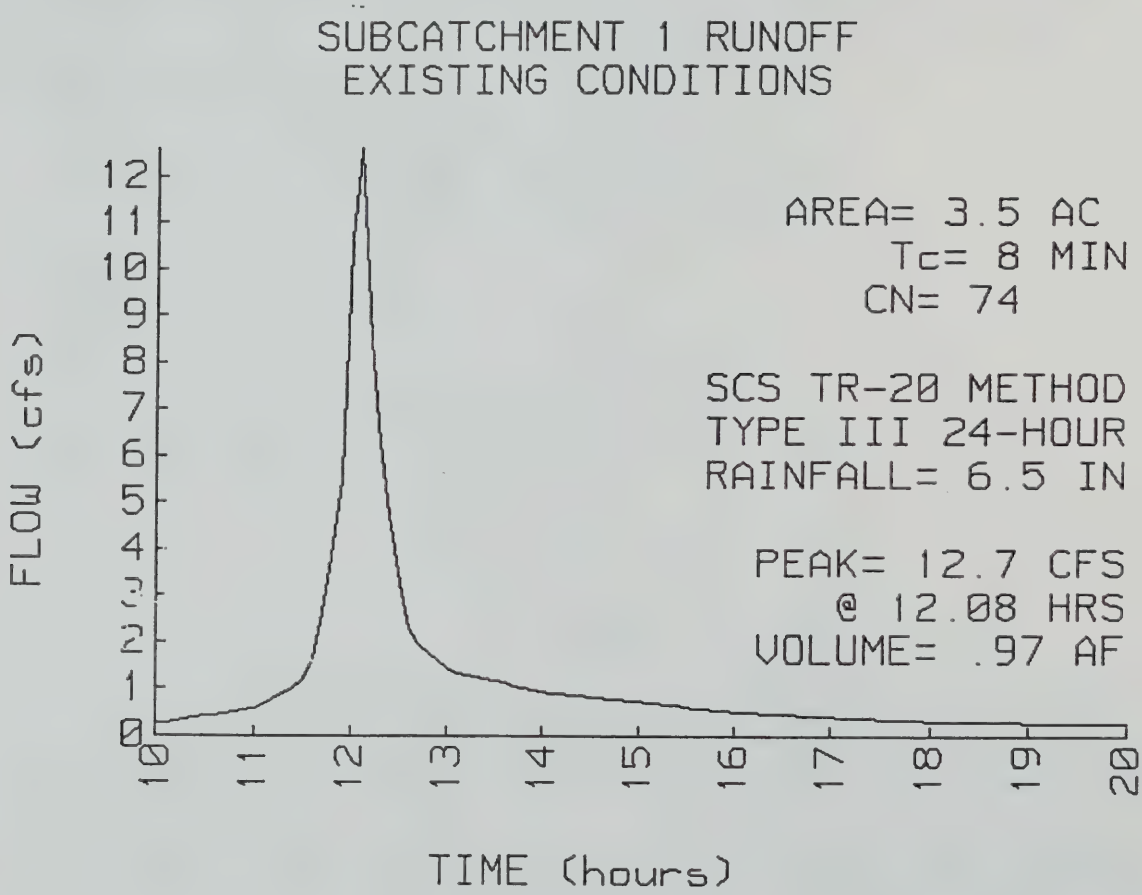
SUBCATCHMENT 1 **EXISTING CONDITIONS** 100 YEAR STORM

ACRES	CN
3.50	74

WEIGHTED CN FROM TR-55

AREA= 3.50 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 12.7 CFS @ 12.08 HRS
VOLUME= .97 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 12.7 CFS @ 12.08 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.3	.3	.3	.3	.4	.4	.4	.5	.5	.6
11.00	.6	.7	.8	.9	1.0	1.2	1.6	2.6	3.8	5.5
12.00	10.6	12.6	8.5	6.3	4.7	3.3	2.3	1.9	1.8	1.6
13.00	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.0	1.0
14.00	.9	.9	.9	.9	.8	.8	.8	.8	.8	.7
15.00	.7	.7	.7	.7	.6	.6	.6	.6	.6	.5
16.00	.5	.5	.5	.5	.5	.5	.4	.4	.4	.4
17.00	.4	.4	.4	.4	.4	.4	.4	.3	.3	.3
18.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

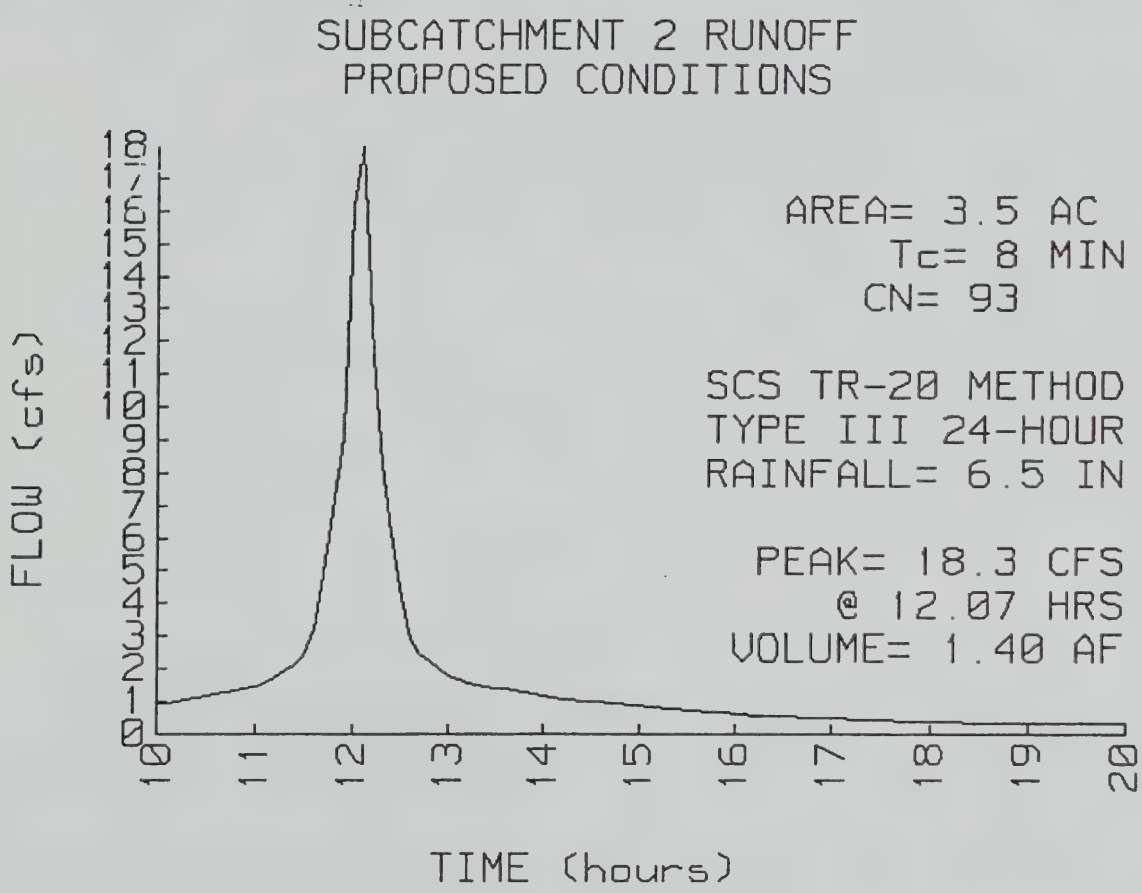
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 100 YEAR STORM

ACRES	CN
3.50	93

WEIGHTED CN FROM TR-55

AREA= 3.50 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 18.3 CFS @ 12.07 HRS
VOLUME= 1.40 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 18.3 CFS @ 12.07 HOURS

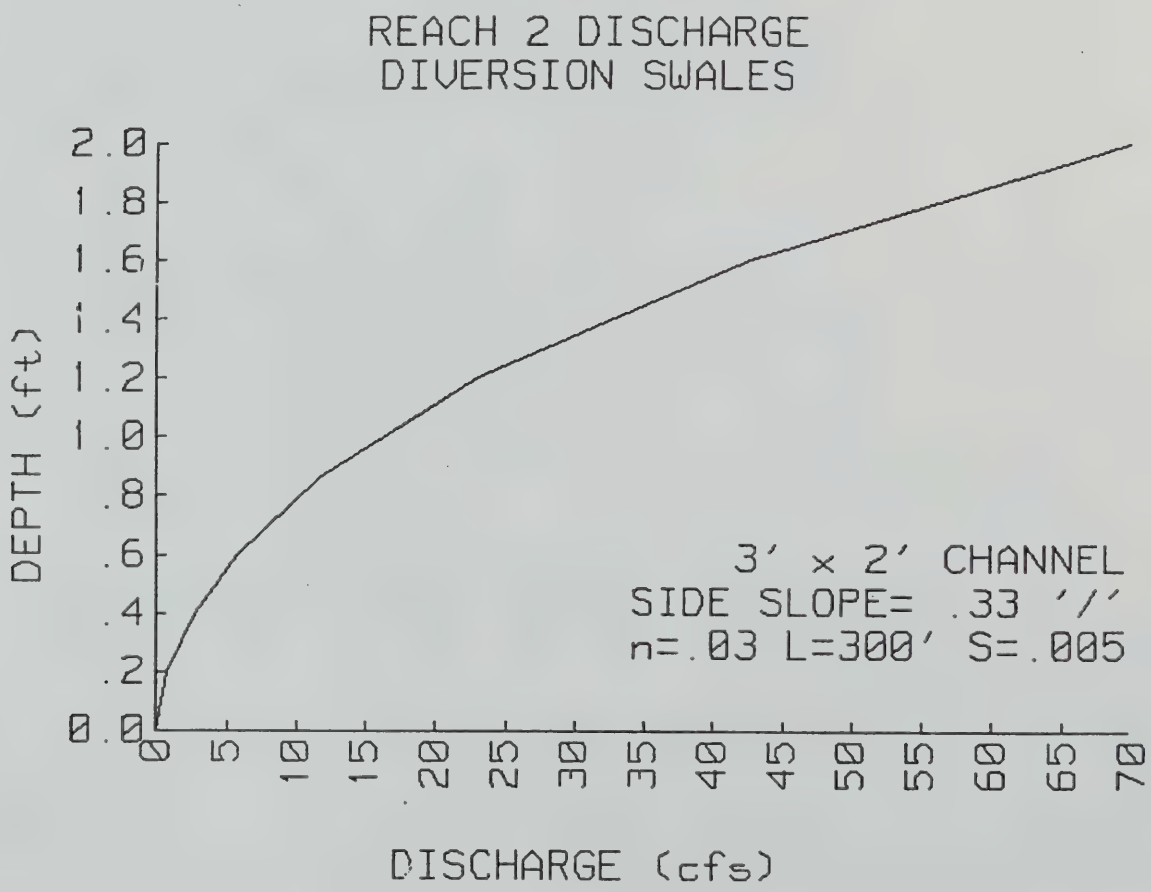
HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4
11.00	1.4	1.6	1.7	1.9	2.1	2.4	3.2	4.9	6.8	9.1
12.00	16.1	18.0	11.5	8.3	6.1	4.2	2.9	2.5	2.2	2.0
13.00	1.8	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
14.00	1.1	1.1	1.1	1.0	1.0	1.0	1.0	.9	.9	.9
15.00	.9	.8	.8	.8	.8	.7	.7	.7	.7	.6
16.00	.6	.6	.6	.6	.6	.5	.5	.5	.5	.5
17.00	.5	.5	.5	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.4	.4	.4	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

REACH 2 **DIVERSION SWALES** 100 YEAR STORM

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.0
.2	.7	.8
.4	1.7	2.7
.6	2.9	5.7
.9	4.8	11.6
1.2	8.0	23.0
1.6	12.6	42.5
2.0	18.1	69.6

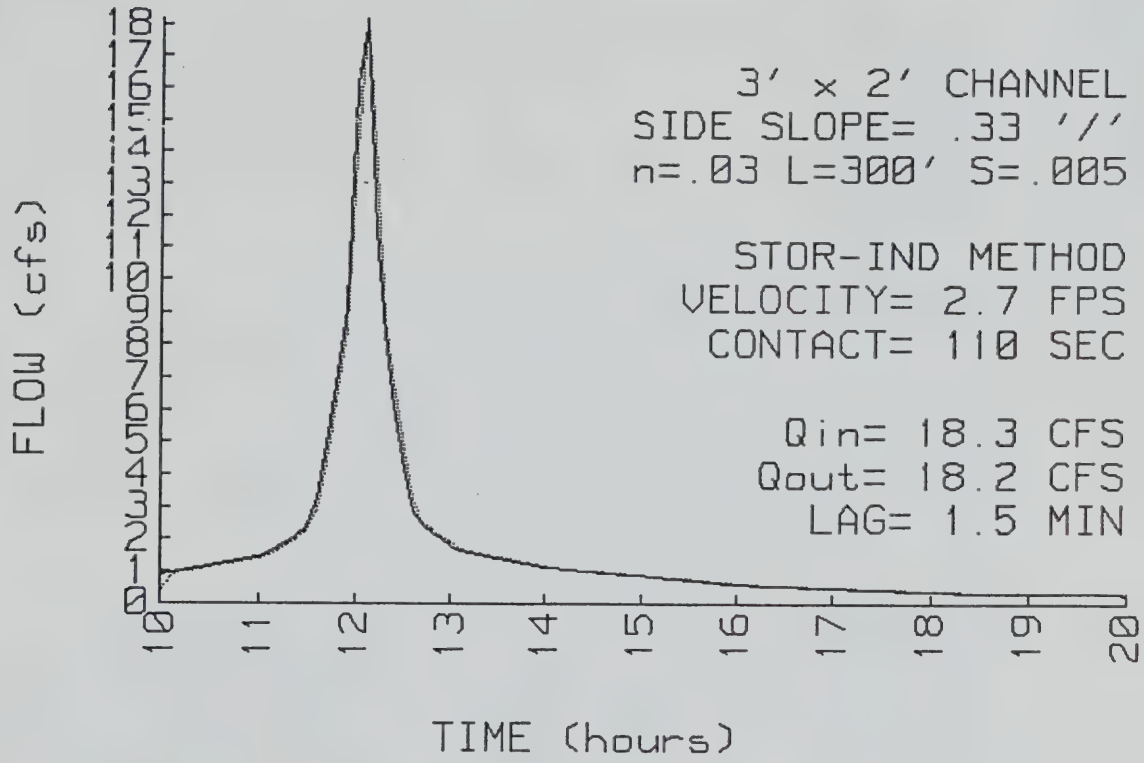
3' x 2' CHANNEL
SIDE SLOPE= .33 '/'
n= .03
LENGTH= 300 FT
SLOPE= .005 FT/FT

STOR-IND METHOD
MAX. DEPTH= 1.06 FT
PEAK VELOCITY= 2.7 FPS
CONTACT TIME = 110 SEC
Qin = 18.3 CFS @ 12.07 HRS
Qout= 18.2 CFS @ 12.10 HRS
ATTEN= 1 % LAG= 1.5 MIN
IN/OUT= 1.40 / 1.40 AF



REACH 2 INFLOW & OUTFLOW
DIVERSION SWALES

100 YEAR STORM



REACH 2 **DIVERSION SWALES**

OUTFLOW PEAK= 18.2 CFS @ 12.10 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.4	.8	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.4
11.00	1.4	1.5	1.7	1.8	2.0	2.3	2.9	4.3	6.2	8.5
12.00	13.9	18.2	13.5	8.8	6.8	4.7	3.3	2.6	2.3	2.1
13.00	1.9	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
14.00	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	.9	.9
15.00	.9	.9	.8	.8	.8	.8	.7	.7	.7	.7
16.00	.6	.6	.6	.6	.6	.5	.5	.5	.5	.5
17.00	.5	.5	.5	.5	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.4	.4	.4	.4	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

5.3.F Ashland Station-East (North Lot)

Objective

To provide a zero net increase to the peak flow rate as storm water enters the existing drainage system.

Assumptions and Methodologies

The design storm has been modelled as a Type III storm in Middlesex County. This results with a 4.5 in. and 6.5 in. 24 hour rainfall for the 10 year and 100 year design storm, respectively. The site drainage area is assumed to be a combination open space with dirt right of ways. The preconstruction quantities of runoff will be handled by the Pleasant Street drainage system. There is an appreciable percentage of infiltration occurring in the existing condition which will continue to be retained on site.

Summary of Peak Flows

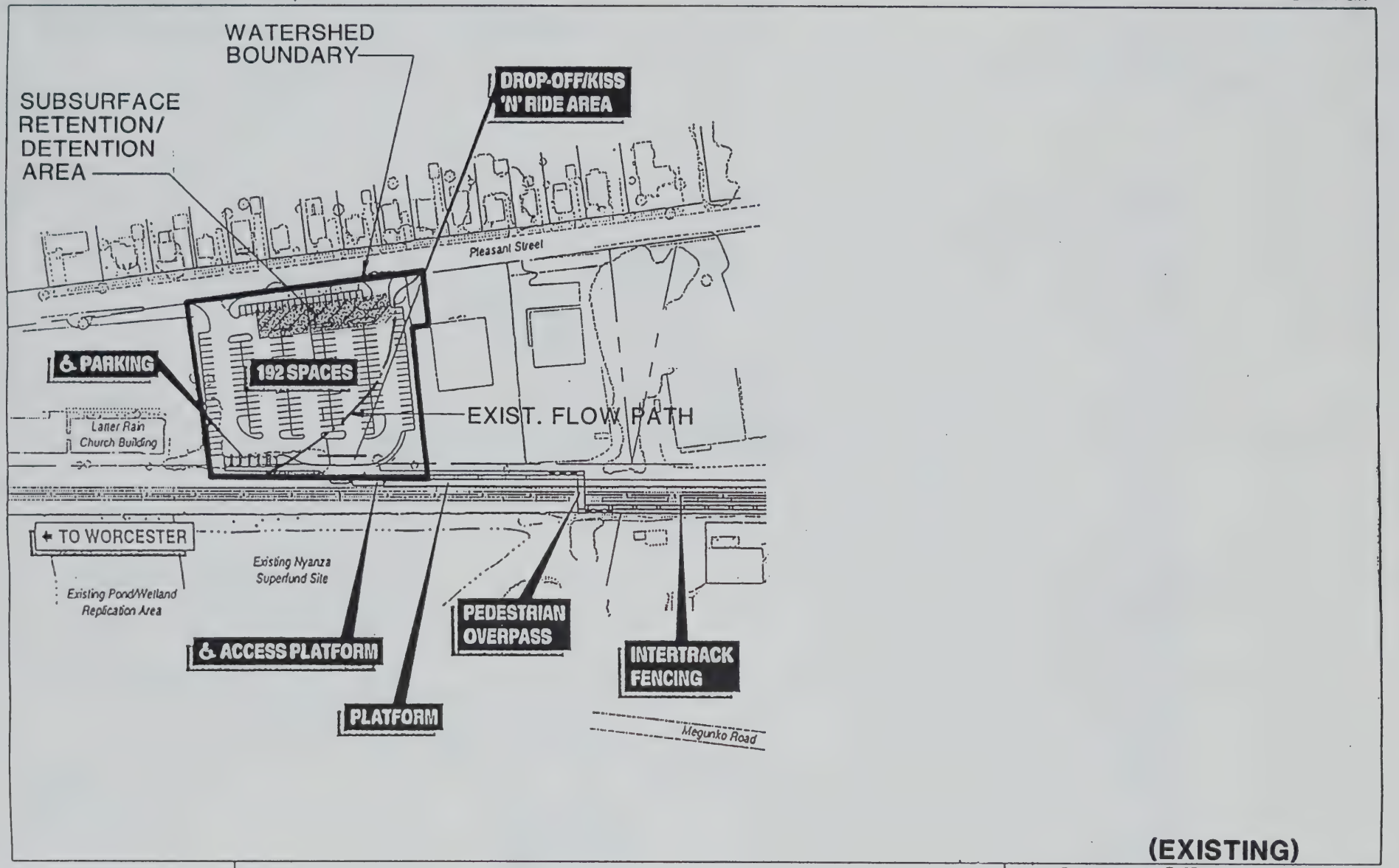
The following Table demonstrates the existing and proposed peak runoff quantities for a 10 year and 100 year design storm.

Table 5.3-17 Peak Runoff Rates - Ashland Station

Storm Event	Existing Conditions	Proposed Conditions
10 Year	2.0 cfs	1.7 cfs
100 Year	4.8 cfs	3.5 cfs

Conclusions

The detention/retention basin has been designed to adequately accommodate the increased runoff generated from proposed construction. The existing condition peak flow rate has not been exceeded. No flooding impacts will result from construction of this station site.

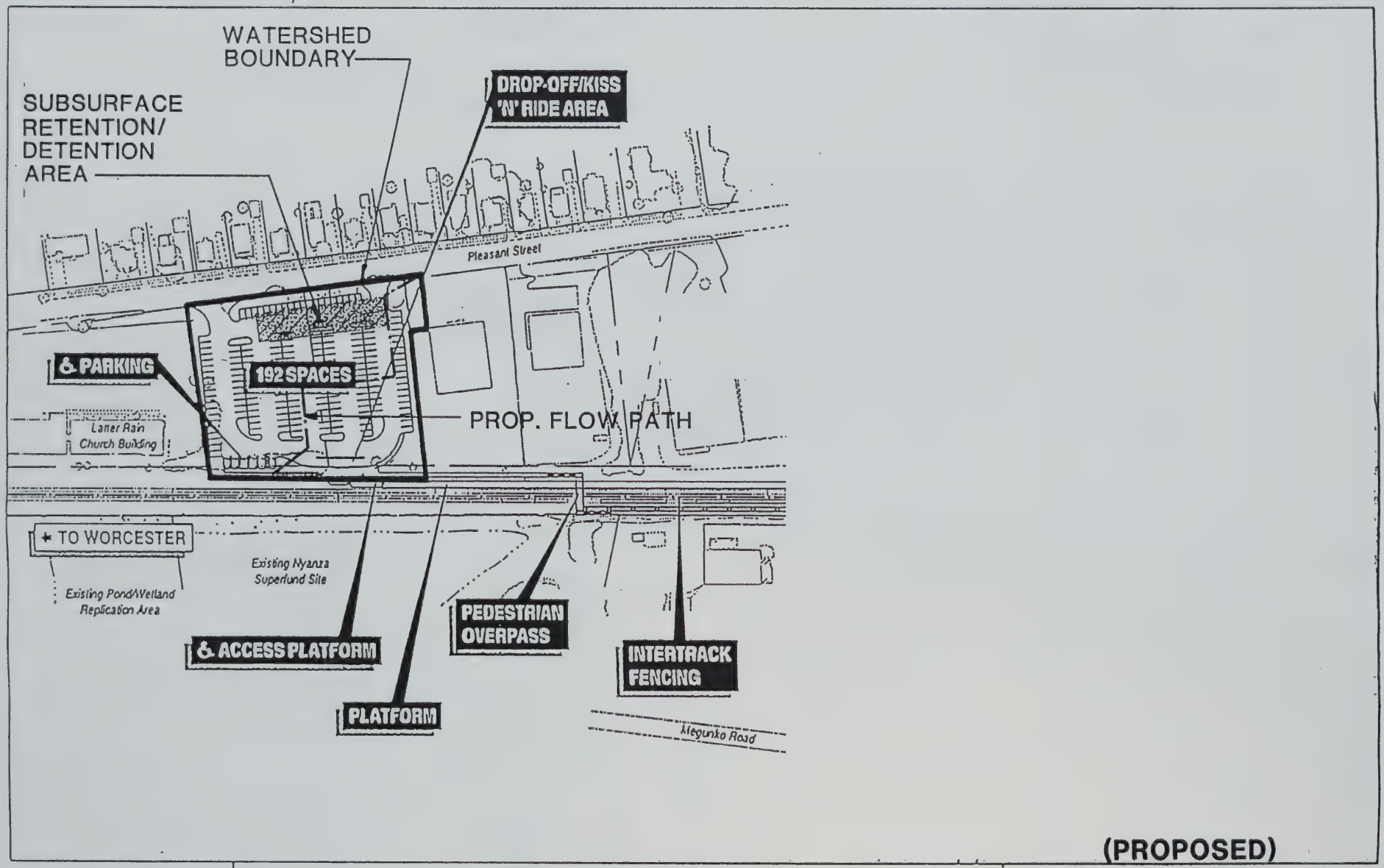


Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200'
0 200

(EXISTING)
NORTH LOT WATERSHED PLAN
ASHLAND EAST ALTERNATIVE

FIGURE 5.3.F-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200'
0 200

(PROPOSED)
NORTH LOT WATERSHED PLAN
ASHLAND EAST ALTERNATIVE

FIGURE 5.3.F-2

Table 5.3-18 Watershed Data - Existing Conditions - North Lot Ashland Station
A = 2.13 AC, .05 AC pavement, 1.04 AC Dirt with R.O.W., 1.04 AC Open Space - Fair
HSG: "A"
L_1 = 50', S=4% (sheet flow), E
L_2 = 360', S=.005% (shallow concentrated), U

From TR-55	CN = 61	
	TOC = .16 hrs = 10 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	1.08 in	2.35 in
Unit Peak Discharge (cfs/acre/in)	.829	.880
Peak Discharge	2 cfs (1.91)	4 cfs (4.40)

Table 5.3-19 Watershed Data - Proposed Conditions - North Lot Ashland Station
A = 2.13 AC, 1.76 AC pavement, .37 AC Open Space - Fair
HSG: "A"
L_1 = 50′, S=4% (sheet flow), E
L_2 = 100′, S=1% (shallow concentrated), P (assumed)
L_3 = 350′, (open channel) <V= 2fps assumed>

From TR-55	CN = 89	
	TOC = .14 hrs = 8 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	3.30 in	5.22 in
Unit Peak Discharge (cfs/acre/in)	.966	.966
Peak Discharge	7 cfs (6.79)	11 cfs (10.74)

36" ∅ HiQ Heavy Duty Pipe (n=010)
3'-0" = I.D.

A = Pi r^2 = Pi $(1.5)^2$ = 7.07 sf

Lengths = 200'
200' x 7.07 sf = 1414 cf per length
7 lengths x 1414 cf = 9,898 cf

Ends - 38'
38' x 7.07 sf - 269 cf per end
2 ends x 269 - 538 cf

Total Pipe Volume - 9,898 + 538 = 10,436 cf

Stone (assumed 40% void)
6" thick bottom layer
212' x 46' x .5' = 4,876 cf
4,876 cf x .40 = *1,950 cf = .0448 AC - ft

3" thick stone

212 x 46' x 3' = 29,256 cf
29,256 cf - 10,436 cf = 18,820 cf
18,820 cf x .40 = 7,528 cf

TOTAL VOID VOLUME

7,528 + 10,436 = 17,964 cf = .412 AC - ft.
.412/3 = .137 AC - ft per 1' depth
17,964/3 = 5,988 cf per 1' depth

Elev.	Vol. cf	Cum. Vol. cf	Cum. Vol. AC -ft.
196.0	0	0	0
196.5	*1,950	1,950	.0448
197.5	5,988	7,938	**.182
198.5	5,988	13,926	.320
199.5	5,988	19.914	.457

** If inv. of 12" ∅ outflow pipe is set at 197.5, the storage volume below is 7,938 cf or .182 AC-ft. This volume is handled by infiltration (18" below invert).

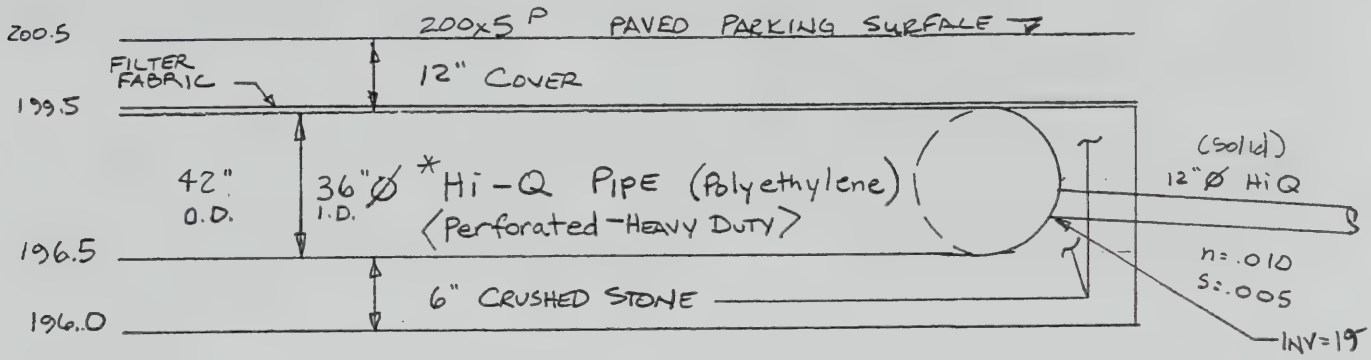
Subsurface Detention/Retention Area Parameters

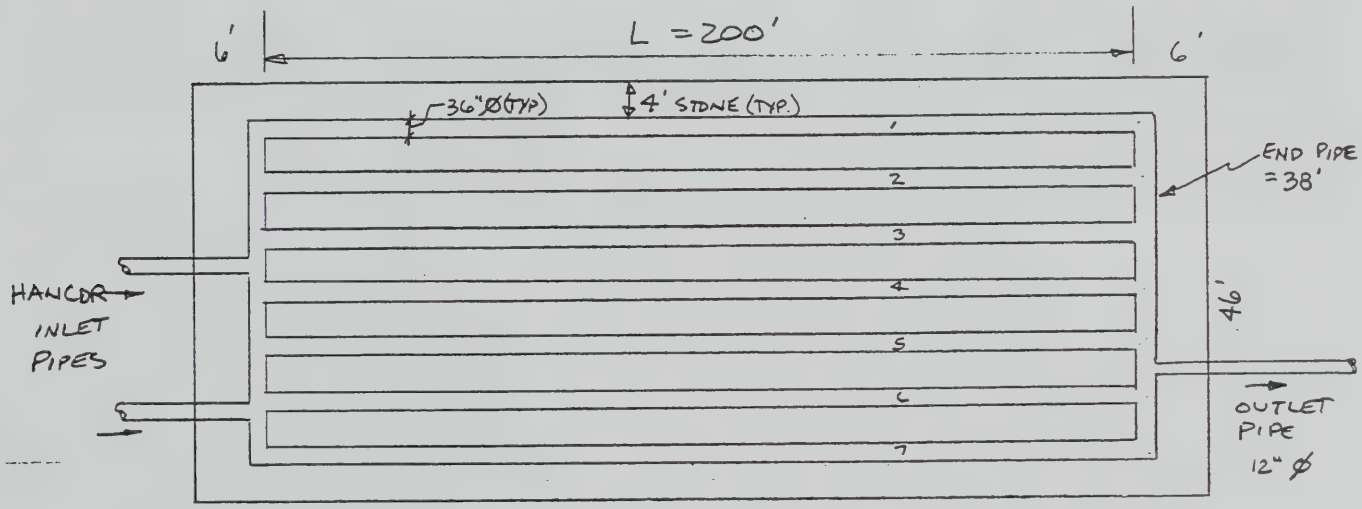
This detention/retention area is designed as a completely enclosed, subsurface basin. It will be constructed with heavy duty perforated polyethylene pipe surrounded with stone and covered with a filter fabric. The piping of the drainage system for the entire parking lot will also be the same plastic pipe for ease of construction and to simplify fittings in and out of the detention structure. The storage volume is a combination of the pipe volume and the void in the stone which is assumed to be 40%. The lower portion of the basin will act as a retention facility to recharge preconstruction quantities infiltrating on-site. The base of the basin will be kept above the water table elevation. The outflow control structure will be a solid plastic 12" diameter pipe which is modelled as a culvert with no tail water effects (n = .01).

EDWARDS AND KELCEY
CONSULTING ENGINEERS

PROJECT: WORCESTER T — FILE NO. 92-3014
SUBJECT: ASHLAND STATION (NORTH) SUBSURFACE RETENTION — SHEET NO. 1 OF 1
COMPUTED BY: R. DAVIS — CHECKED BY: — DATE: 7/27/94

*SEE MANUFACTURERS SPEC. Hi Q PRODUCTS





L' = 212'

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(NORTH) User: RLD Date: 07-09-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
	Acres (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Fair condition; grass cover 50% to 75%	1.04(49)	-	-	-
Impervious Areas				
Paved parking lots, roofs, driveways	.05(98)	-	-	-
Streets and roads				
Dirt (w/ right-of-way)	1.04(72)	-	-	-
Total Area (by Hydrologic Soil Group)	2.13			

SUBAREA: ONE TOTAL DRAINAGE AREA: 2.13 Acres WEIGHTED CURVE NUMBER:61*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(NORTH) User: RLD Date: 07-09-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.1	50	.04	E					0.068
Shallow Concent'd		360	.005	U					0.088
								Time of Concentration =	0.16*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(NORTH) User: RLD Date: 07-12-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
	Acres (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Fair condition; grass cover 50% to 75%	.37(49)	-	-	-
Impervious Areas				
Paved parking lots, roofs, driveways	1.76(98)	-	-	-
Total Area (by Hydrologic Soil Group)	2.13			

SUBAREA: ONE TOTAL DRAINAGE AREA: 2.13 Acres WEIGHTED CURVE NUMBER:89*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(NORTH) User: RLD Date: 07-12-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.1	50	.04	E					0.068
Shallow Concent'd		100	.005	P					0.019
Open Channel		350						2	0.049
								Time of Concentration =	0.14*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

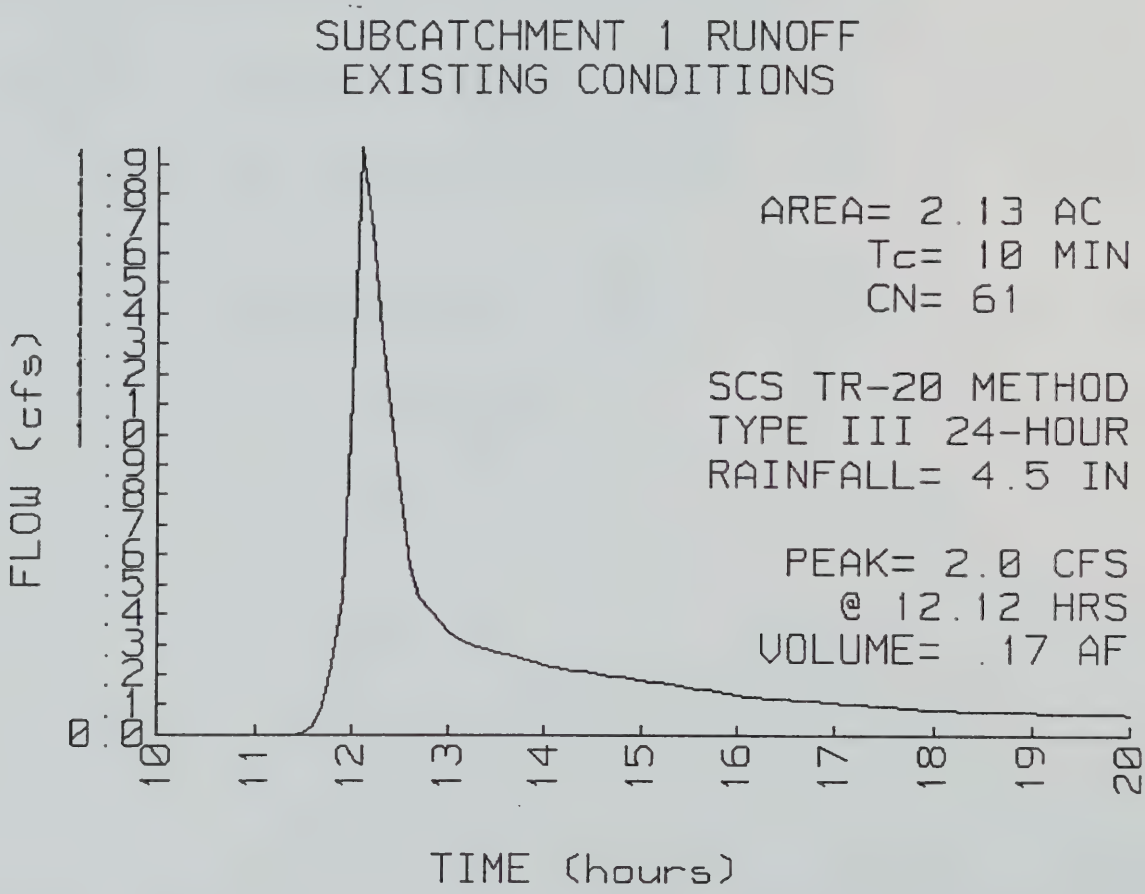
SUBCATCHMENT 1 **EXISTING CONDITIONS** 10 YEAR STORM

ACRES	CN
2.13	61

WEIGHTED CN FROM TR-55

AREA= 2.13 AC Tc= 10 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 2.0 CFS @ 12.12 HRS
VOLUME= .17 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 2.0 CFS @ 12.12 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.5
12.00	1.1	2.0	1.7	1.3	1.1	.8	.6	.5	.4	.4
13.00	.3	.3	.3	.3	.3	.3	.3	.3	.2	.2
14.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
15.00	.2	.2	.2	.2	.2	.2	.2	.1	.1	.1
16.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
17.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

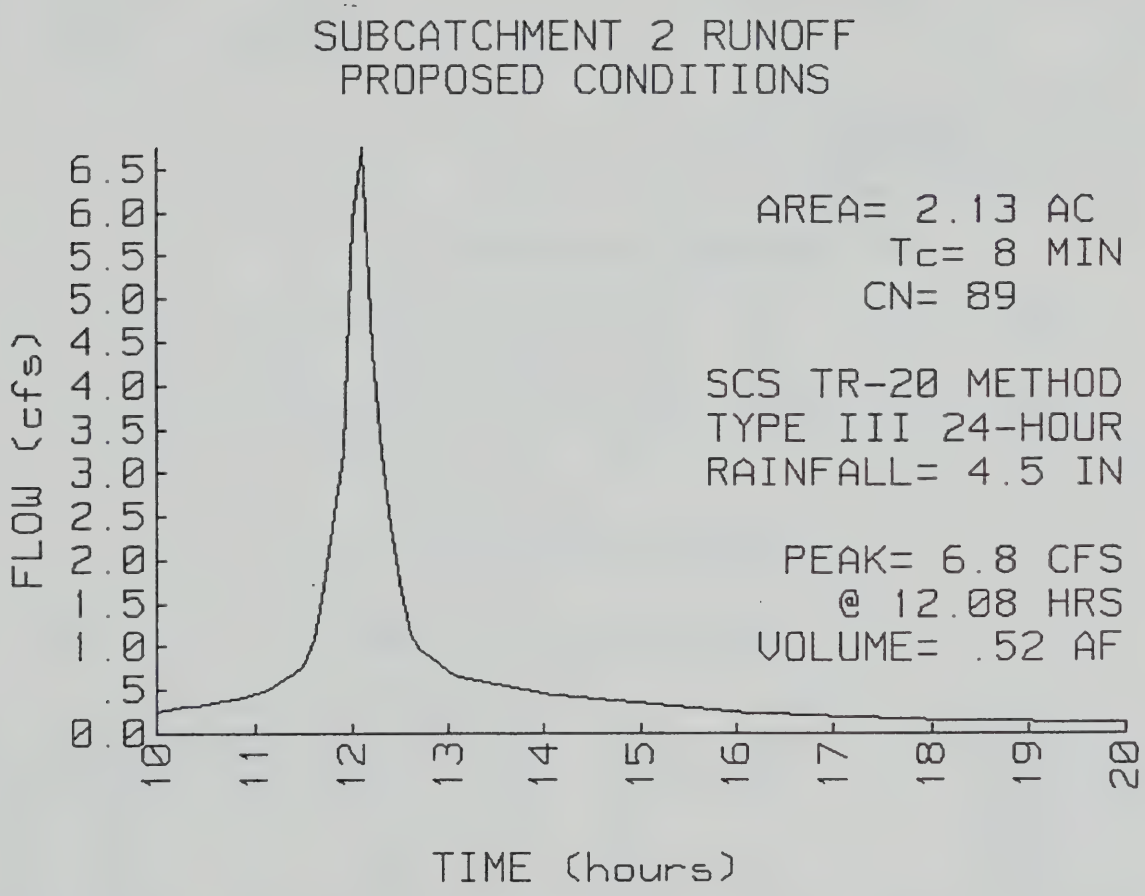
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 10 YEAR STORM

ACRES	CN
2.13	89

WEIGHTED CN FROM TR-55

AREA= 2.13 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 6.8 CFS @ 12.08 HRS
VOLUME= .52 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 6.8 CFS @ 12.08 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.3	.3	.3	.3	.3	.3	.4	.4	.4	.4
11.00	.4	.5	.6	.6	.7	.8	1.1	1.7	2.4	3.2
12.00	5.9	6.8	4.4	3.2	2.4	1.6	1.1	1.0	.9	.8
13.00	.7	.7	.6	.6	.6	.6	.5	.5	.5	.5
14.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
15.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
16.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
17.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

POND 2 **RETENTION/DETENTION AREA** 10 YEAR STORM

STARTING ELEV= 196.0 FT
FLOOD ELEV= 199.5 FT

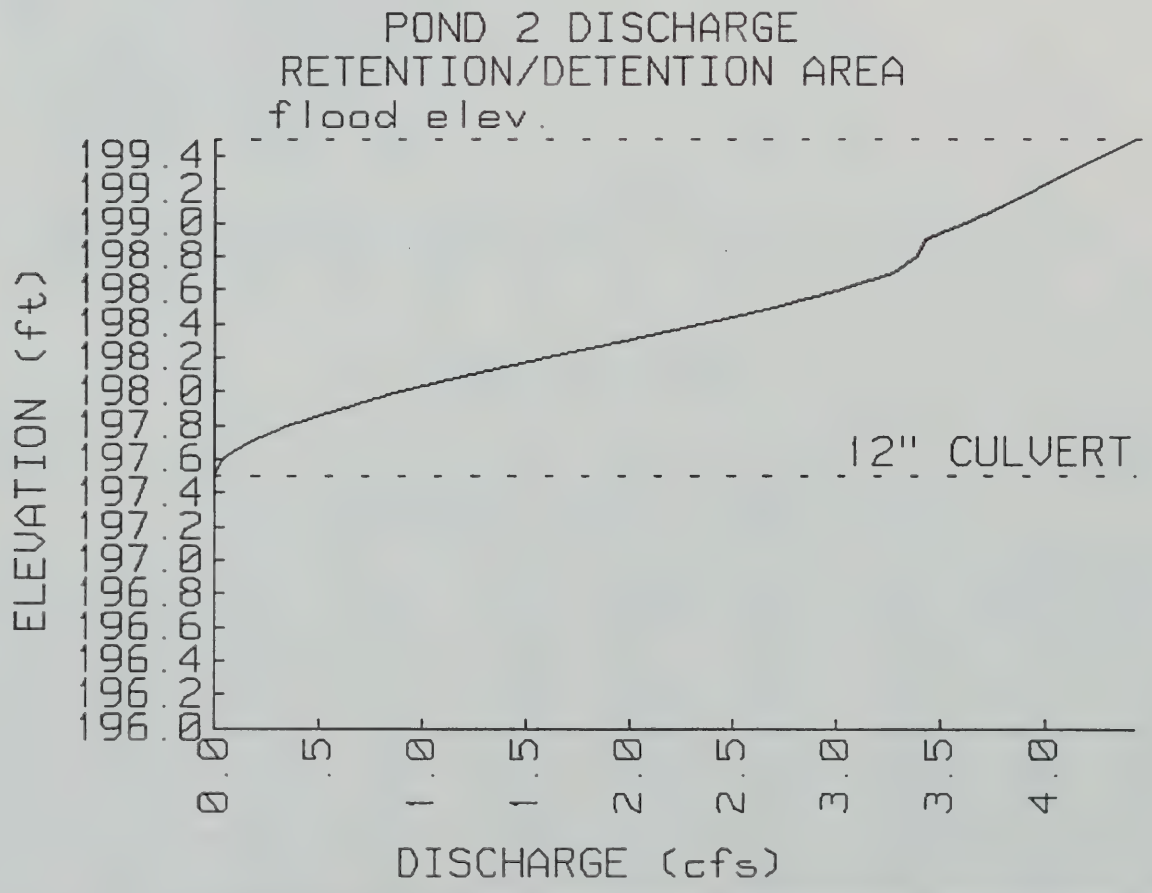
ELEVATION (FT)	CUM.STOR (AF)
196.0	0.00
196.5	.04
197.5	.18
198.5	.32
199.5	.46

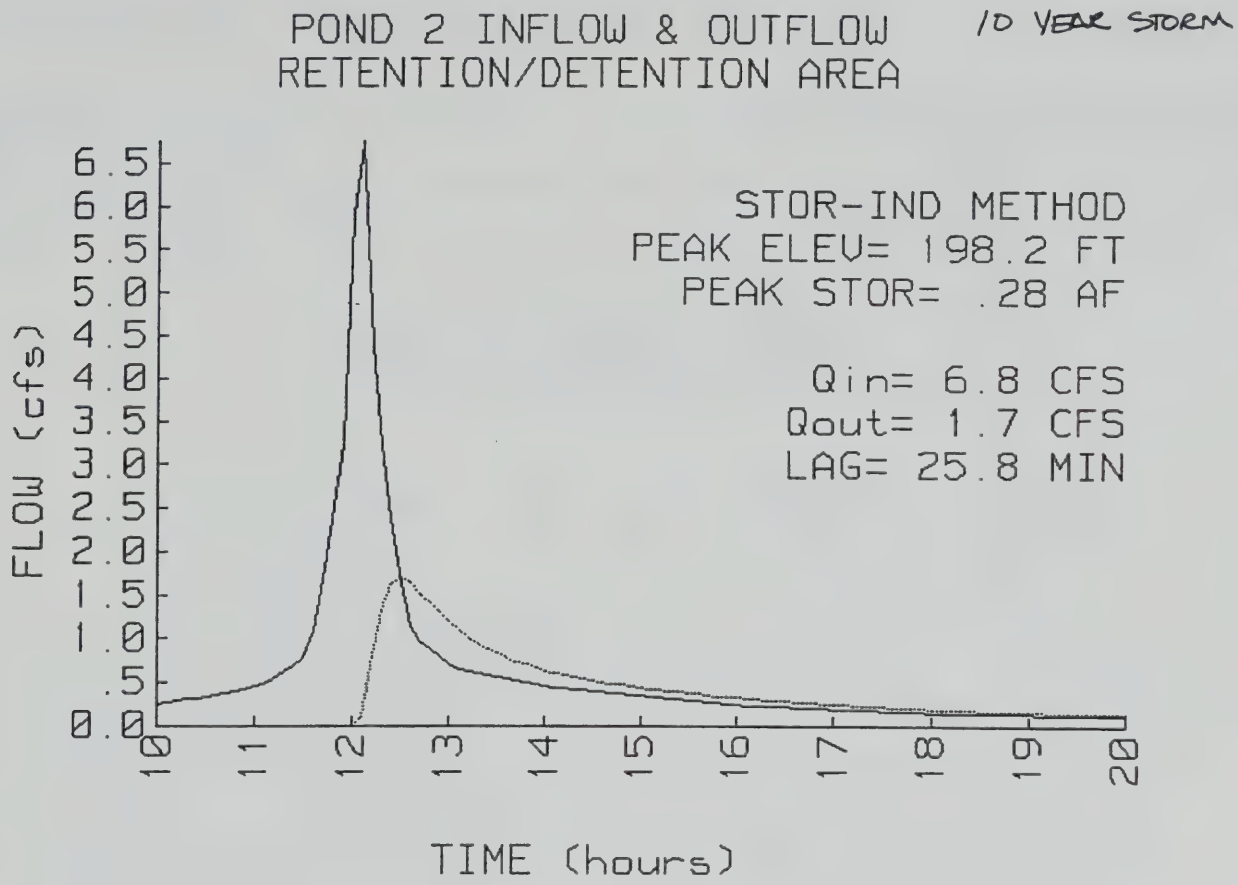
STOR-IND METHOD
PEAK ELEVATION= 198.2 FT
PEAK STORAGE = .28 AF
Qin = 6.8 CFS @ 12.08 HRS
Qout= 1.7 CFS @ 12.51 HRS
ATTEN= 75 % LAG= 25.8 MIN
IN/OUT= .52 / .31 AF

INVERT (FT)	OUTLET DEVICES
197.5	**12" CULVERT**
	n=.01 L=100′ S=.005′/′ Ke=.2 Cc=.9 Cd=.75

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
196.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
197.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.2	.3	.6
198.0	.9	1.2	1.6	2.0	2.3	2.7	3.0	3.3	3.4	3.4
199.0	3.6	3.8	4.0	4.1	4.3	4.4				





POND 2 **RETENTION/DETENTION AREA**

OUTFLOW PEAK= 1.7 CFS @ 12.51 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.00	0.0	.1	.8	1.3	1.6	1.7	1.6	1.5	1.4	1.3
13.00	1.2	1.1	1.0	.9	.9	.8	.8	.7	.7	.7
14.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.5
15.00	.4	.4	.4	.4	.4	.4	.4	.4	.3	.3
16.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
17.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.1	.1	.1	.1	.1	.1
20.00	.1									

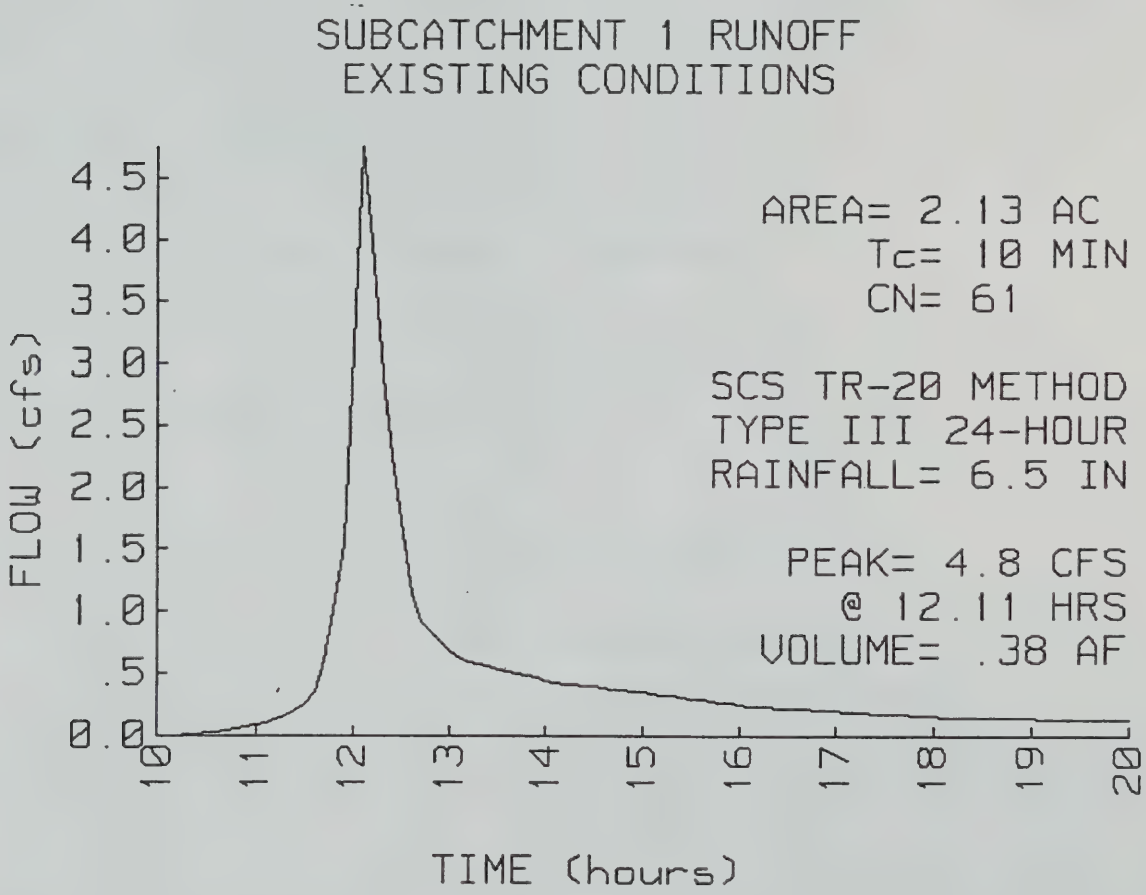
SUBCATCHMENT 1 **EXISTING CONDITIONS** 100 YEAR STORM

ACRES	CN
2.13	61

WEIGHTED CN FROM TR-55

AREA= 2.13 AC Tc= 10 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 4.8 CFS @ 12.11 HRS
VOLUME= .38 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 4.8 CFS @ 12.11 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1
11.00	.1	.1	.1	.2	.2	.2	.4	.6	1.0	1.6
12.00	3.1	4.8	3.8	2.9	2.3	1.6	1.1	.9	.8	.7
13.00	.7	.6	.6	.6	.6	.5	.5	.5	.5	.5
14.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
15.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
16.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
17.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
18.00	.2	.2	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

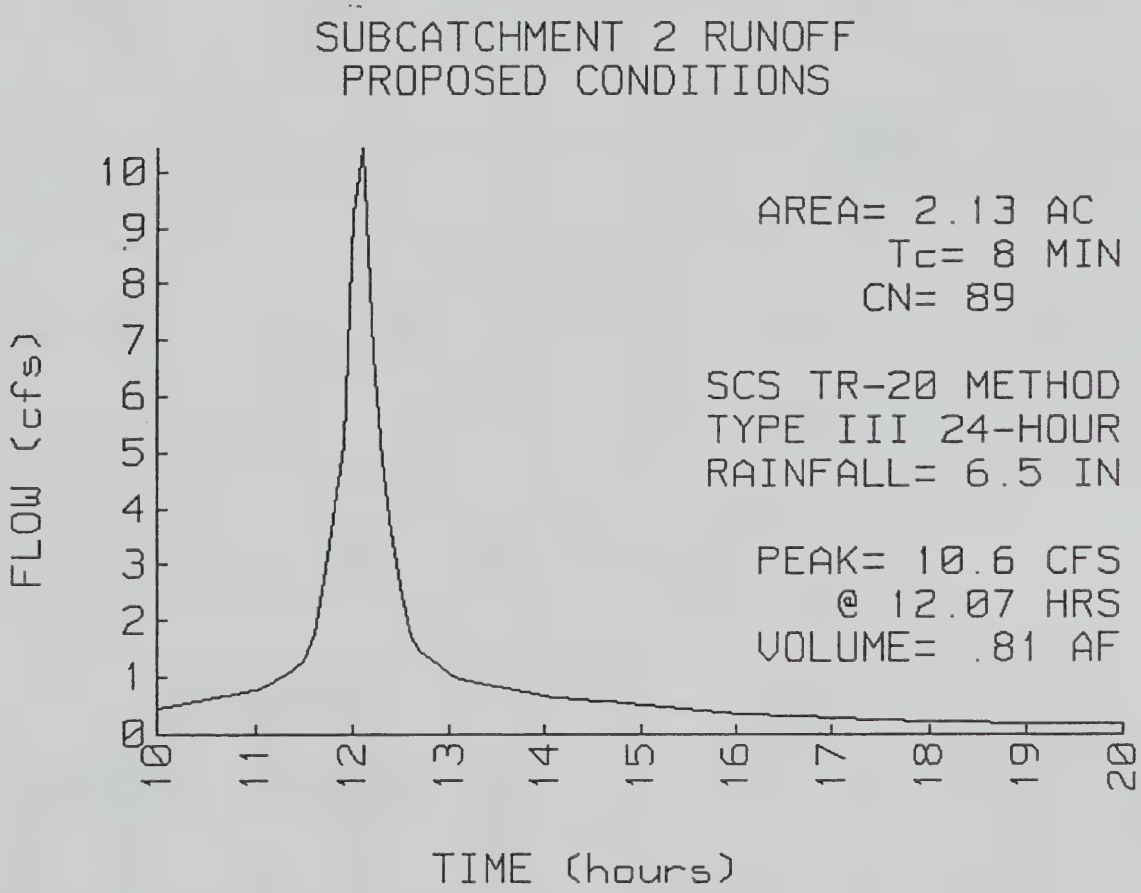
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 100 YEAR STORM

ACRES	CN
2.13	89

WEIGHTED CN FROM TR-55

AREA= 2.13 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 10.6 CFS @ 12.07 HRS
VOLUME= .81 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 10.6 CFS @ 12.07 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.5	.5	.5	.5	.6	.6	.6	.7	.7	.7
11.00	.8	.8	.9	1.0	1.2	1.3	1.8	2.7	3.8	5.1
12.00	9.2	10.4	6.7	4.9	3.6	2.5	1.7	1.5	1.3	1.2
13.00	1.1	1.0	.9	.9	.9	.8	.8	.8	.7	.7
14.00	.7	.7	.6	.6	.6	.6	.6	.6	.5	.5
15.00	.5	.5	.5	.5	.5	.4	.4	.4	.4	.4
16.00	.4	.4	.3	.3	.3	.3	.3	.3	.3	.3
17.00	.3	.3	.3	.3	.3	.3	.2	.2	.2	.2
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

POND 2 **RETENTION/DETENTION AREA** 100 YEAR STORM

STARTING ELEV= 196.0 FT
FLOOD ELEV= 199.5 FT

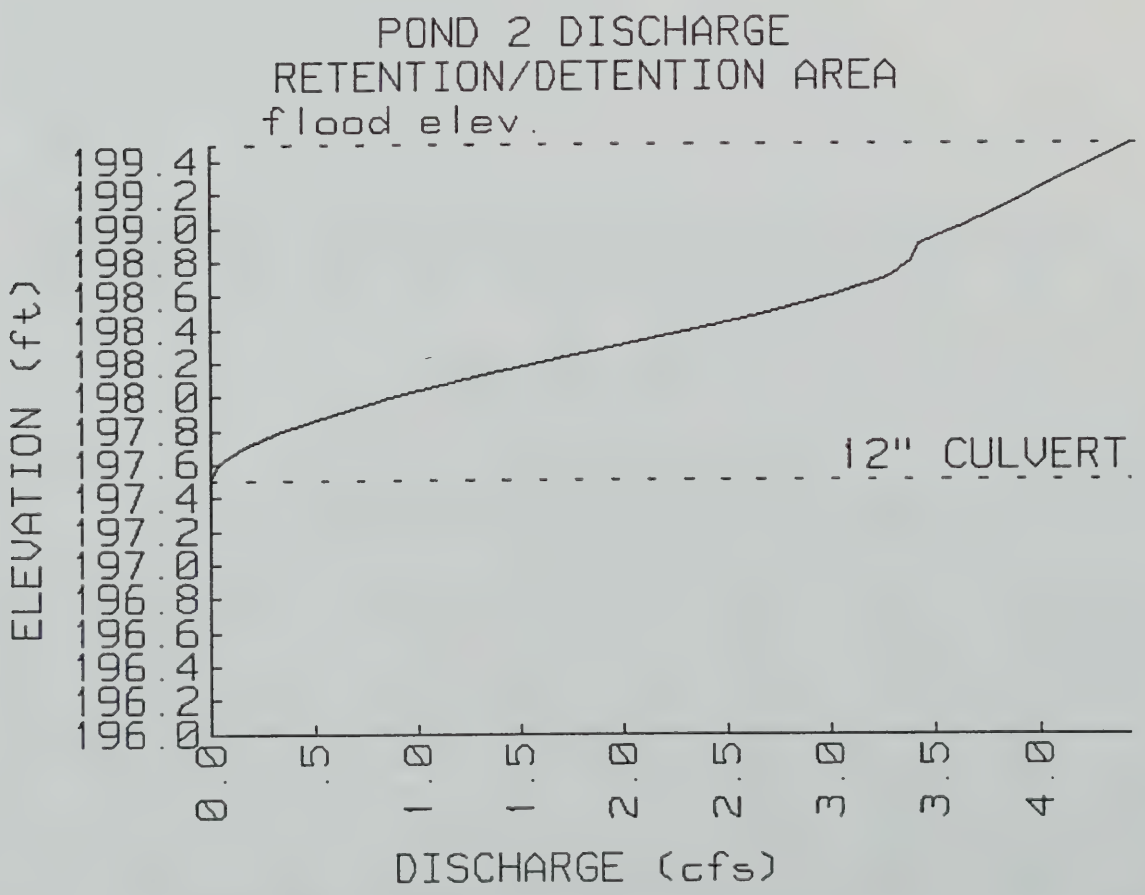
ELEVATION (FT)	CUM.STOR (AF)
196.0	0.00
196.5	.04
197.5	.18
198.5	.32
199.5	.46

STOR-IND METHOD
PEAK ELEVATION= 199.0 FT
PEAK STORAGE = .38 AF
Qin = 10.6 CFS @ 12.07 HRS
Qout= 3.5 CFS @ 12.41 HRS
ATTEN= 67 % LAG= 20.2 MIN
IN/OUT= .81 / .59 AF

INVERT (FT)	OUTLET DEVICES
197.5	**12" CULVERT** n=.01 L=100' S=.005'/' Ke=.2 Cc=.9 Cd=.75

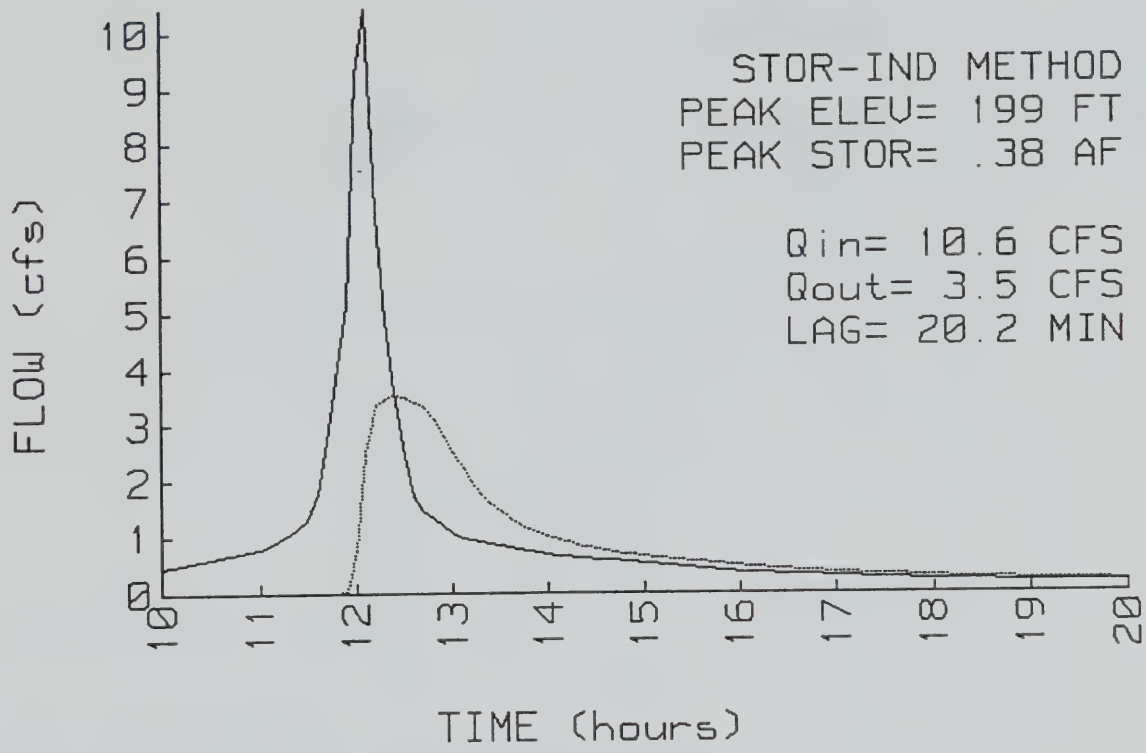
TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
196.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
197.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.2	.3	.6
198.0	.9	1.2	1.6	2.0	2.3	2.7	3.0	3.3	3.4	3.4
199.0	3.6	3.8	4.0	4.1	4.3	4.4				



POND 2 INFLOW & OUTFLOW
RETENTION/DETENTION AREA

100 YEAR STORM



POND 2 **RETENTION/DETENTION AREA**

OUTFLOW PEAK= 3.5 CFS @ 12.41 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.00	.8	2.5	3.4	3.5	3.5	3.5	3.4	3.3	3.1	2.8
13.00	2.5	2.2	2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.1
14.00	1.0	.9	.9	.8	.8	.8	.7	.7	.7	.7
15.00	.6	.6	.6	.6	.6	.5	.5	.5	.5	.5
16.00	.5	.5	.4	.4	.4	.4	.4	.4	.4	.4
17.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
18.00	.3	.3	.3	.3	.3	.3	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

5.3.G Ashland Station-East (South Lot)

Objective

To provide a zero net increase to the peak flow rate as storm water enters the existing water course.

Assumptions and Methodologies

The design storm has been modelled as a Type III storm in Middlesex County. This results with a 4.5 in. and 6.5 in. 24 hour rainfall for the 10 year and 100 year design storm, respectively. The site drainage area is assumed to be half wooded and half grassland in the existing condition. By maintaining or reducing peak flow rates to the preconstruction quantities, no adverse impacts on the receiving water course will be experienced.

Summary of Peak Flows

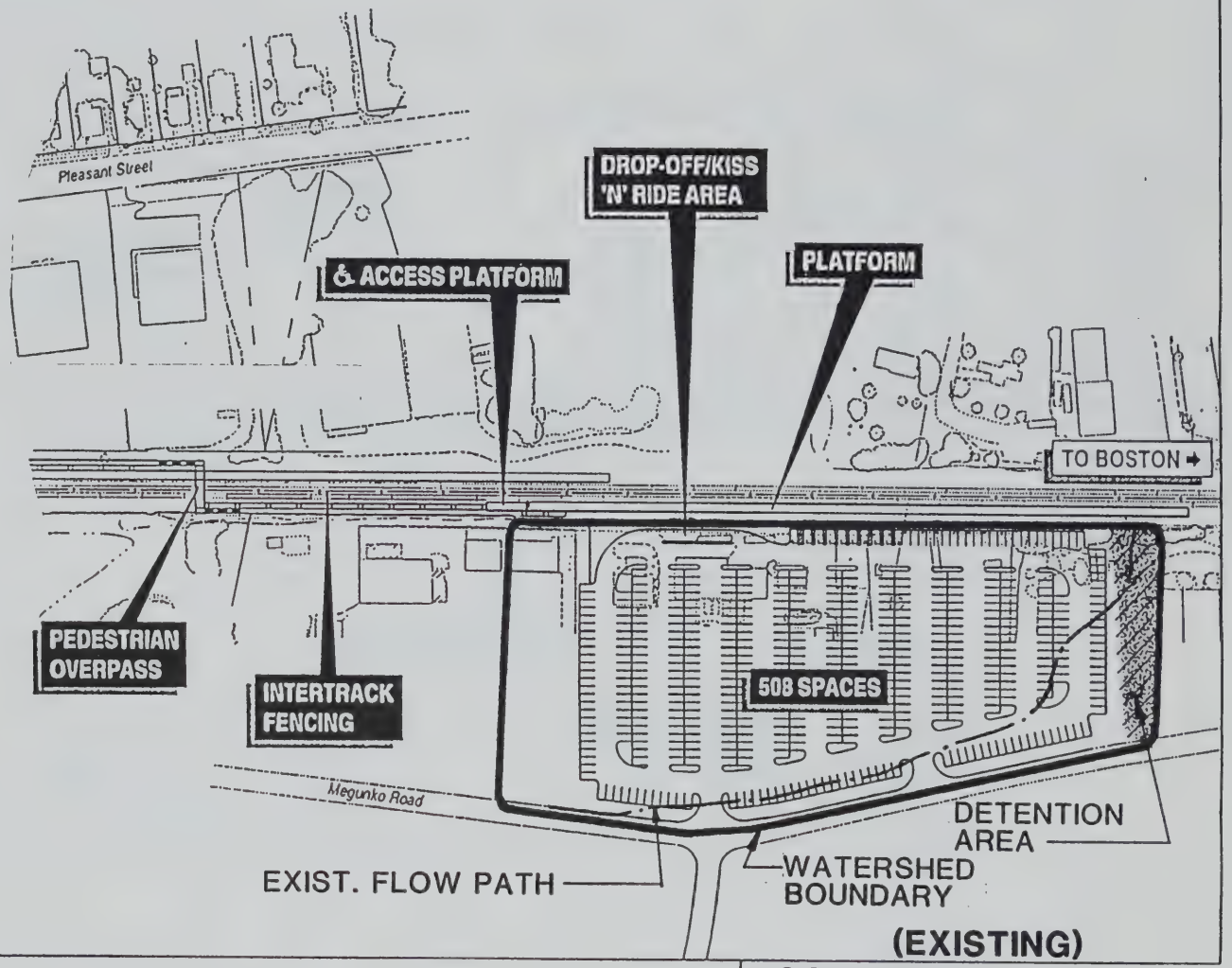
The following Table demonstrates the existing and proposed peak runoff quantities for a 10 year and 100 year design storm.

Table 5.3-20 Peak Runoff Rates - Ashland Station

Storm Event	Existing Conditions	Proposed Conditions
10 Year	15.0 cfs	13.0 cfs
100 Year	24.7 cfs	18.7 cfs

Conclusions

The detention basin has been designed to adequately accommodate the increased runoff generated from proposed construction. The existing condition peak flow rate has not been exceeded. No flooding impacts will result from construction of this station site.



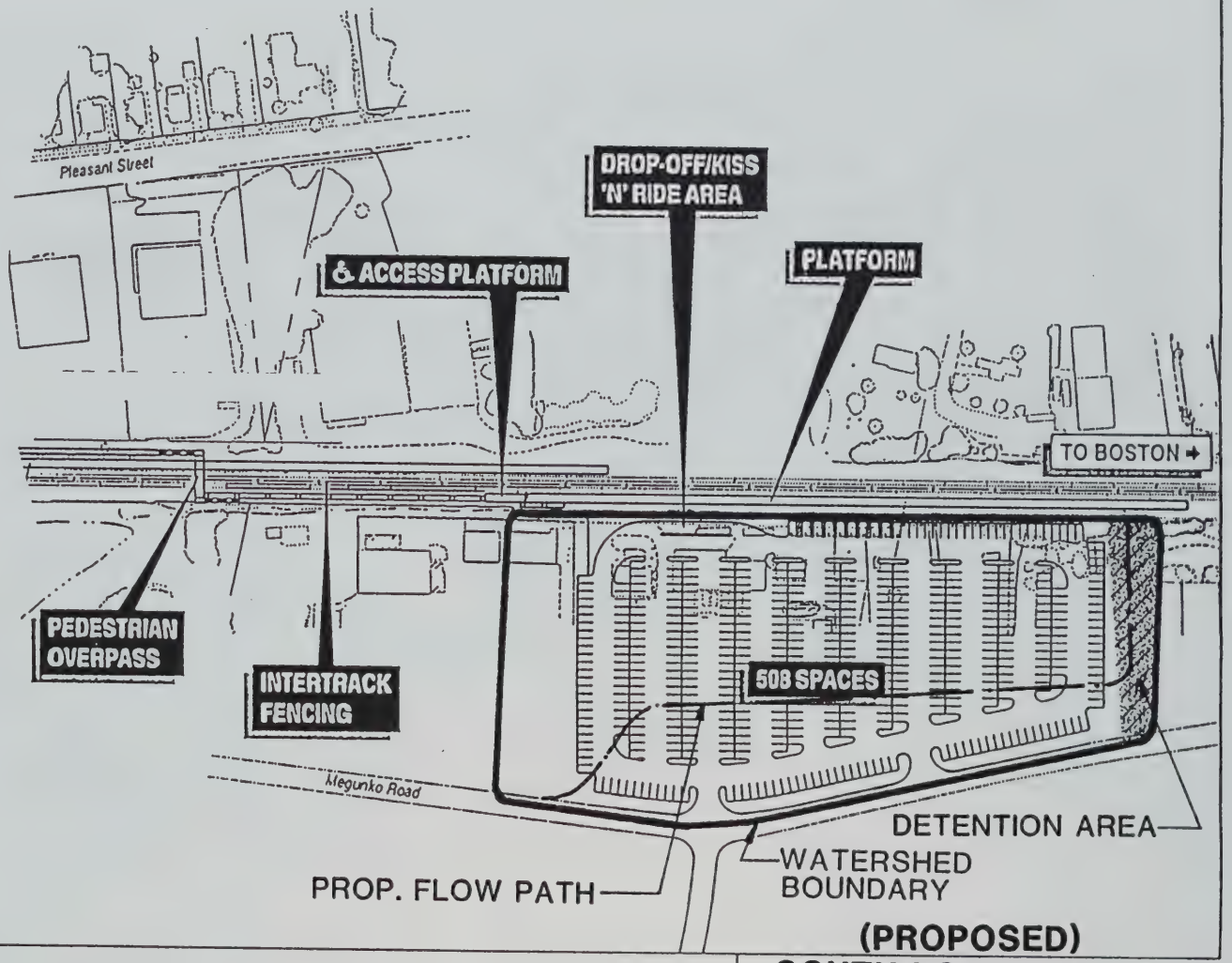
(EXISTING)

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200'
0 200

SOUTH LOT WATERSHED PLAN
ASHLAND EAST ALTERNATIVE

FIGURE 5-3.G-1



(PROPOSED)

SOUTH LOT WATERSHED PLAN

ASHLAND EAST ALTERNATIVE

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200'

0 200

FIGURE 5.3.G-2

Table 5.3-21 Watershed Data - Existing Conditions - South Lot Ashland Station
A = 5.60 AC, (assumed 50% paved) (50% grass/range - poor)
HSG: "A"
L_1 = 50′, S=1.4% (sheet flow), A
L_2 = 630′, S=1% (shallow concentrated), P
L_3 = 220′, (open channel) <V = 1 fps assumed>

From TR-55	CN = 83	
	TOC = .16 hrs = 10 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	2.73 in	4.56 in
Unit Peak Discharge (cfs/acre/in)	.936	.936
Peak Discharge	14 cfs (14.31)	24 cfs (23.90)

Table 5.3-22 Watershed Data - Proposed Conditions - North Lot Ashland Station
A = 5.60 AC, (4.29 AC Paved) (1.31 AC Grass/Range - Poor)
HSG: "A"
L_1 = 50′, S=1.4% (sheet flow), A
L_2 = 70′, S=1.0% (shallow concentrated), U
L_3 = 100′, S=1.0% (shallow concentrated), P
L_4 = 750′, (open channel) <V=2 fps assumed>

From TR-55	CN = 91	
	TOC = 14 hrs = 8 mins.	
	10 Year	**100 Year**
24 Hr Rainfall	4.5 in	6.5 in
Direct Runoff	3.50 in	5.45 in
Unit Peak Discharge (cfs/acre/in)	.966	.966
Peak Discharge	19 cfs (18.93)	29 cfs (29.48)

Detention Pond Parameters

This detention basin is designed with three horizontal to one vertical (3:1) sideslopes. The outlet device will be a concrete 24" diameter reinforced concrete pipe. It has been modelled to act as a culvert with no tail water effects. The discharge will tie into the existing brook. Outlets are to include a rip rap apron to slow velocities and dissipate hydraulic energies. The bottom and sideslopes of the basin will be loamed and seeded.

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(SOUTH) User: RLD Date: 07-09-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
		Acres (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		2.80(98)	-	-	-
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	poor	2.80(68)	-	-	-
Total Area (by Hydrologic Soil Group)		5.6			

SUBAREA: ONE TOTAL DRAINAGE AREA: 5.6 Acres WEIGHTED CURVE NUMBER:83*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(SOUTH) User: RLD Date: 07-09-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: EXISTING CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.1	50	.014	A					0.014
Shallow Concent'd		630	.01	P					0.086
Open Channel		220						1	0.061
								Time of Concentration =	0.16*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

TR-55 CURVE NUMBER COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(SOUTH) User: RLD Date: 07-09-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS
Subarea : ONE

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
		Acres (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Impervious Areas					
Paved parking lots, roofs, driveways		4.29(98)	-	-	-
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	poor	1.31(68)	-	-	-
Total Area (by Hydrologic Soil Group)		5.6			

SUBAREA: ONE TOTAL DRAINAGE AREA: 5.6 Acres WEIGHTED CURVE NUMBER:91*

* - Generated for use by GRAPHIC method

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : WORC. T ASHLAND STATION(SOUTH) User: RLD Date: 07-09-94
County : MIDDLESEX State: MA Checked: ____ Date: _____
Subtitle: PROPOSED CONDITIONS

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.1	50	.014	A					0.014
Shallow Concent'd		70	.01	U					0.012
Shallow Concent'd		100	.01	P					0.014
Open Channel		750						2	0.104
						Time of Concentration =			0.14*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

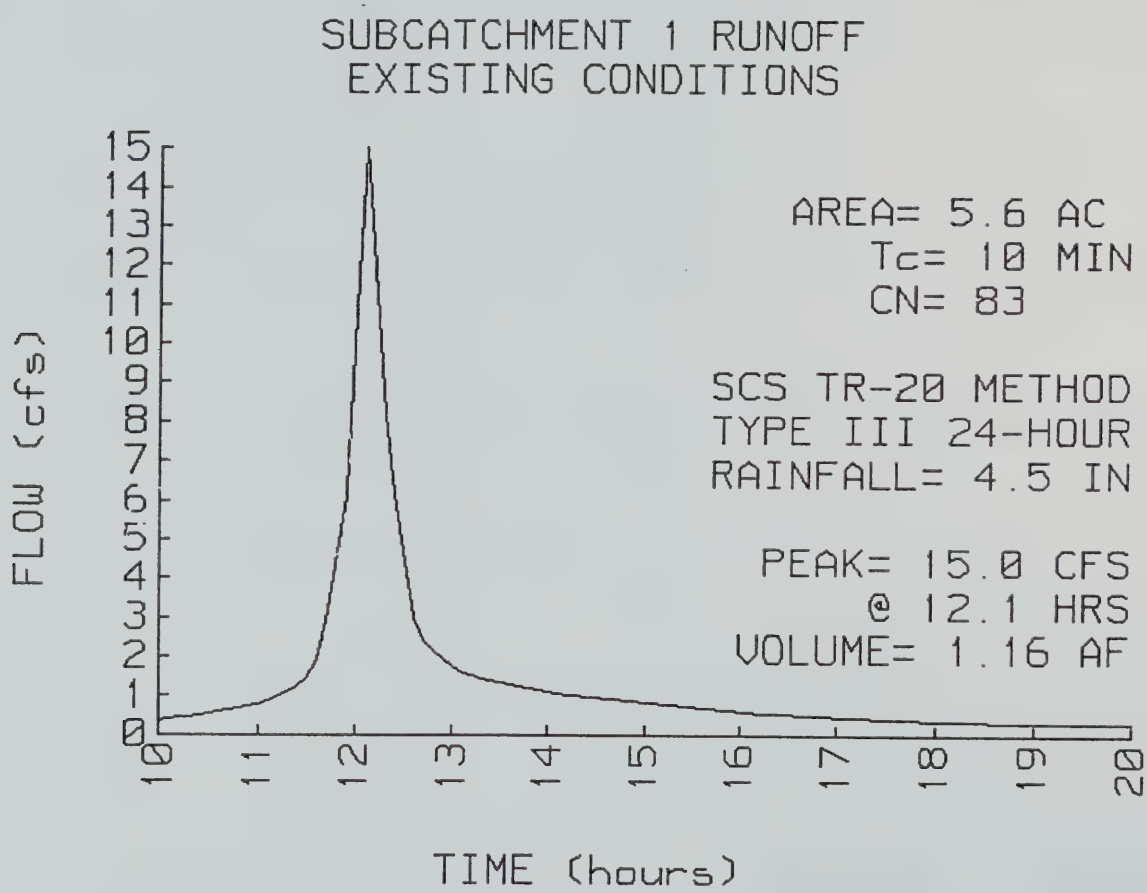
SUBCATCHMENT 1 **EXISTING CONDITIONS** 10 YEAR STORM

ACRES	CN
5.60	83

WEIGHTED CN FROM TR-55

AREA= 5.60 AC Tc= 10 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 15.0 CFS @ 12.10 HRS
VOLUME= 1.16 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 15.0 CFS @ 12.10 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.4	.4	.4	.5	.5	.6	.6	.6	.7	.7
11.00	.8	.9	1.0	1.1	1.3	1.4	1.9	3.0	4.4	6.1
12.00	10.[illegible]	15.0	11.3	8.2	6.2	4.4	3.0	2.4	2.1	1.9
13.00	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.2
14.00	1.1	1.1	1.0	1.0	1.0	1.0	.9	.9	.9	.9
15.00	.8	.8	.8	.8	.7	.7	.7	.7	.6	.6
16.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.5
17.00	.5	.5	.5	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.4	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

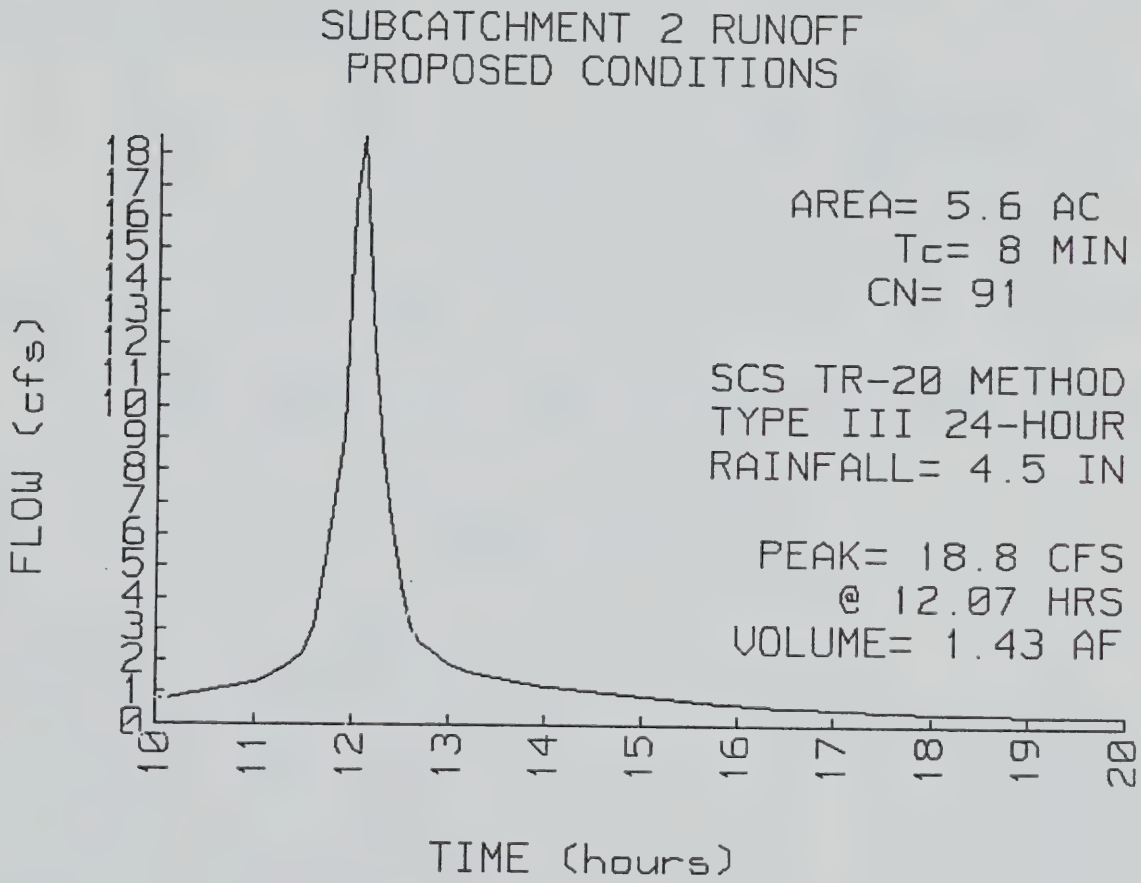
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 10 YEAR STORM

ACRES	CN
5.60	91

WEIGHTED CN FROM TR-55

AREA= 5.60 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 4.5 IN
PEAK= 18.8 CFS @ 12.07 HRS
VOLUME= 1.43 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 18.8 CFS @ 12.07 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.8	.8	.9	.9	1.0	1.0	1.1	1.1	1.2	1.3
11.00	1.3	1.4	1.6	1.8	2.0	2.3	3.1	4.8	6.7	9.1
12.00	16.4	18.6	12.0	8.7	6.5	4.4	3.1	2.6	2.4	2.1
13.00	1.9	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.3	1.3
14.00	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
15.00	.9	.9	.9	.8	.8	.8	.8	.7	.7	.7
16.00	.7	.6	.6	.6	.6	.6	.6	.6	.5	.5
17.00	.5	.5	.5	.5	.5	.5	.4	.4	.4	.4
18.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
19.00	.4	.4	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

POND 2 **DETENTION BASIN** 10 YEAR STORM

STARTING ELEV= 192.3 FT
FLOOD ELEV= 196.0 FT

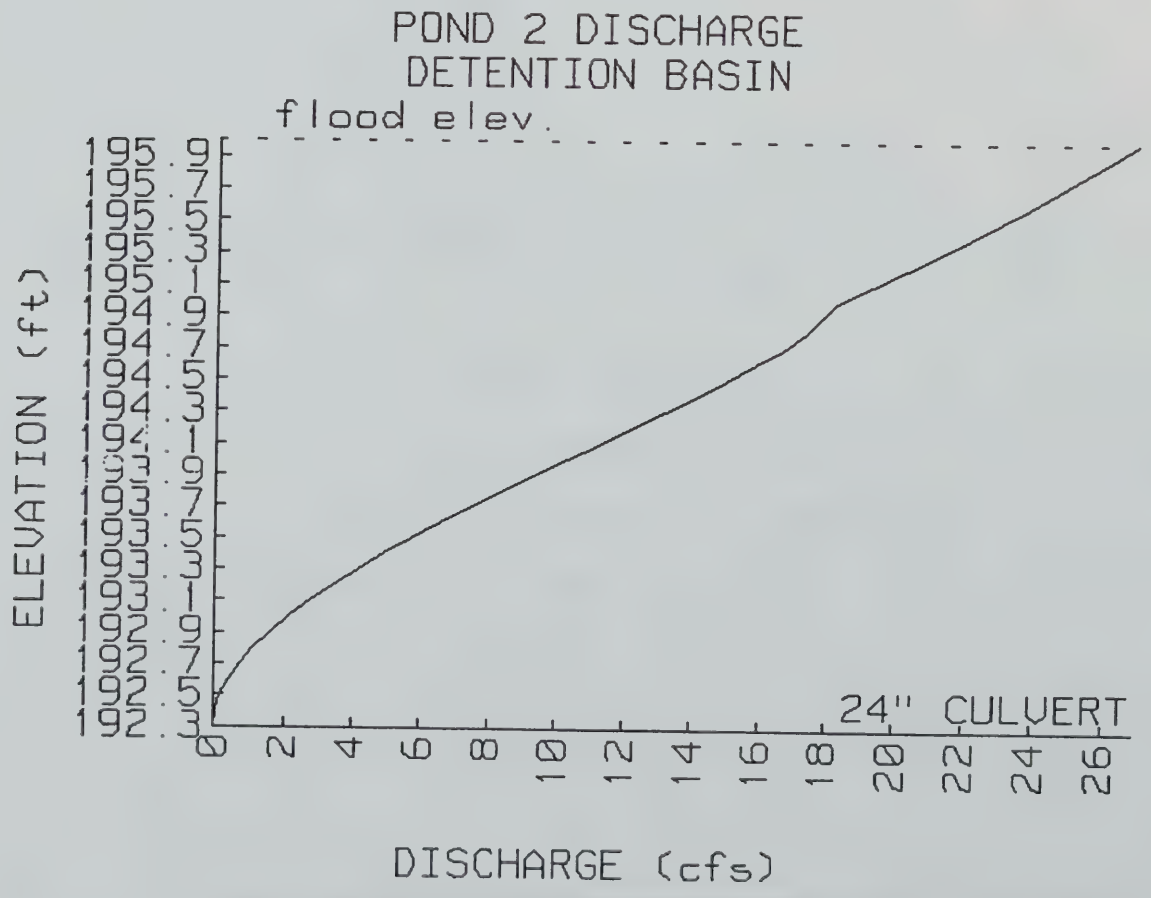
ELEVATION (FT)	CUM.STOR (AF)
192.3	0.00
193.0	.09
194.0	.24
196.0	.59

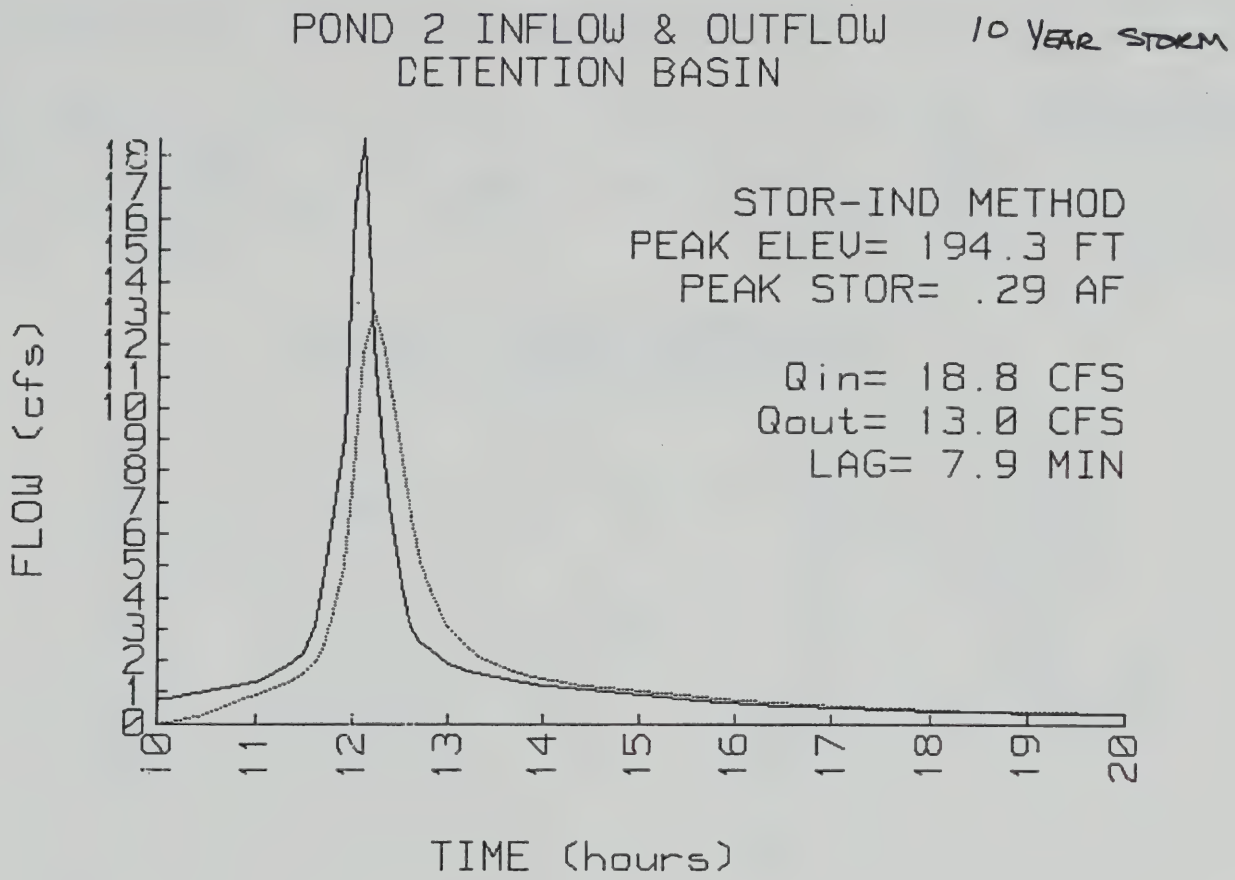
STOR-IND METHOD
PEAK ELEVATION= 194.3 FT
PEAK STORAGE = .29 AF
Qin = 18.8 CFS @ 12.07 HRS
Qout= 13.0 CFS @ 12.21 HRS
ATTEN= 31 % LAG= 7.9 MIN
IN/OUT= 1.43 / 1.40 AF

INVERT (FT)	OUTLET DEVICES
192.3	**24" CULVERT**
	n=.013 L=30' S=.005'/' Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
192.3	0.0	0.0	.2	.4	.7	1.1	1.6	2.1	2.8	3.4
193.3	4.1	4.9	5.7	6.6	7.5	8.4	9.3	10.3	11.3	12.2
194.3	13.2	14.1	15.0	15.9	16.7	17.3	17.8	18.3	19.3	20.3
195.3	21.2	22.1	23.0	23.8	24.6	25.4	26.2	26.9		





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= 13.0 CFS @ 12.21 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	.1	.1	.2	.3	.4	.6	.7	.8
11.00	.9	1.0	1.1	1.3	1.4	1.6	1.9	2.5	3.5	5.0
12.00	8.0	11.7	13.0	12.1	10.4	8.4	6.5	5.1	4.2	3.5
13.00	3.1	2.7	2.4	2.2	2.0	1.9	1.8	1.7	1.6	1.5
14.00	1.4	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1
15.00	1.0	1.0	1.0	1.0	.9	.9	.9	.8	.8	.8
16.00	.8	.7	.7	.7	.7	.7	.6	.6	.6	.6
17.00	.6	.6	.6	.5	.5	.5	.5	.5	.5	.5
18.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
19.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.3
20.00	.3									

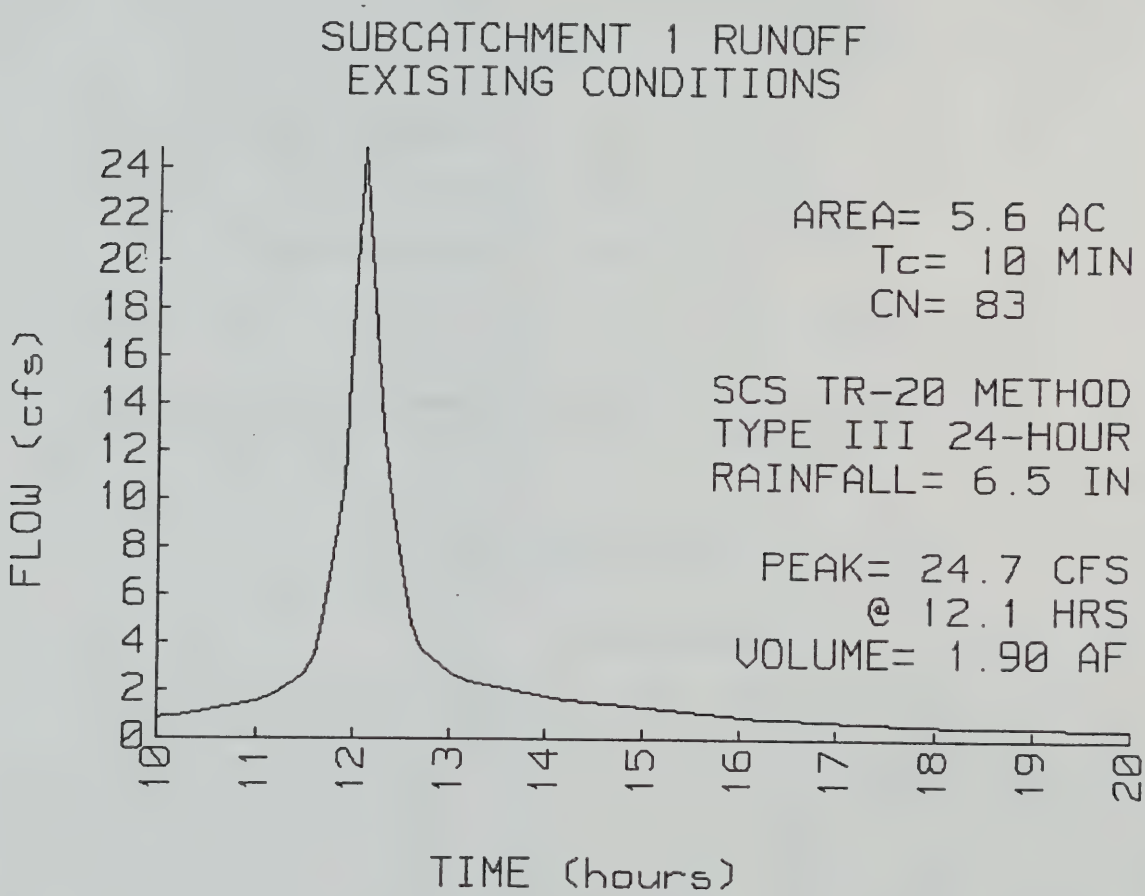
SUBCATCHMENT 1 **EXISTING CONDITIONS** 100 YEAR STORM

ACRES	CN
5.60	83

WEIGHTED CN FROM TR-55

AREA= 5.60 AC Tc= 10 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 24.7 CFS @ 12.10 HRS
VOLUME= 1.90 AF



SUBCATCHMENT 1 **EXISTING CONDITIONS**

RUNOFF PEAK= 24.7 CFS @ 12.10 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	.8	.9	.9	1.0	1.1	1.2	1.2	1.3	1.4	1.5
11.00	1.5	1.7	1.9	2.1	2.4	2.7	3.5	5.3	7.7	10.6
12.00	18.3	24.7	18.3	13.1	9.8	6.9	4.7	3.8	3.4	3.0
13.00	2.7	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8
14.00	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.3
15.00	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.0	1.0	1.0
16.00	.9	.9	.9	.8	.8	.8	.8	.8	.8	.7
17.00	.7	.7	.7	.7	.7	.6	.6	.6	.6	.6
18.00	.6	.5	.5	.5	.5	.5	.5	.5	.5	.5
19.00	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
20.00	.5									

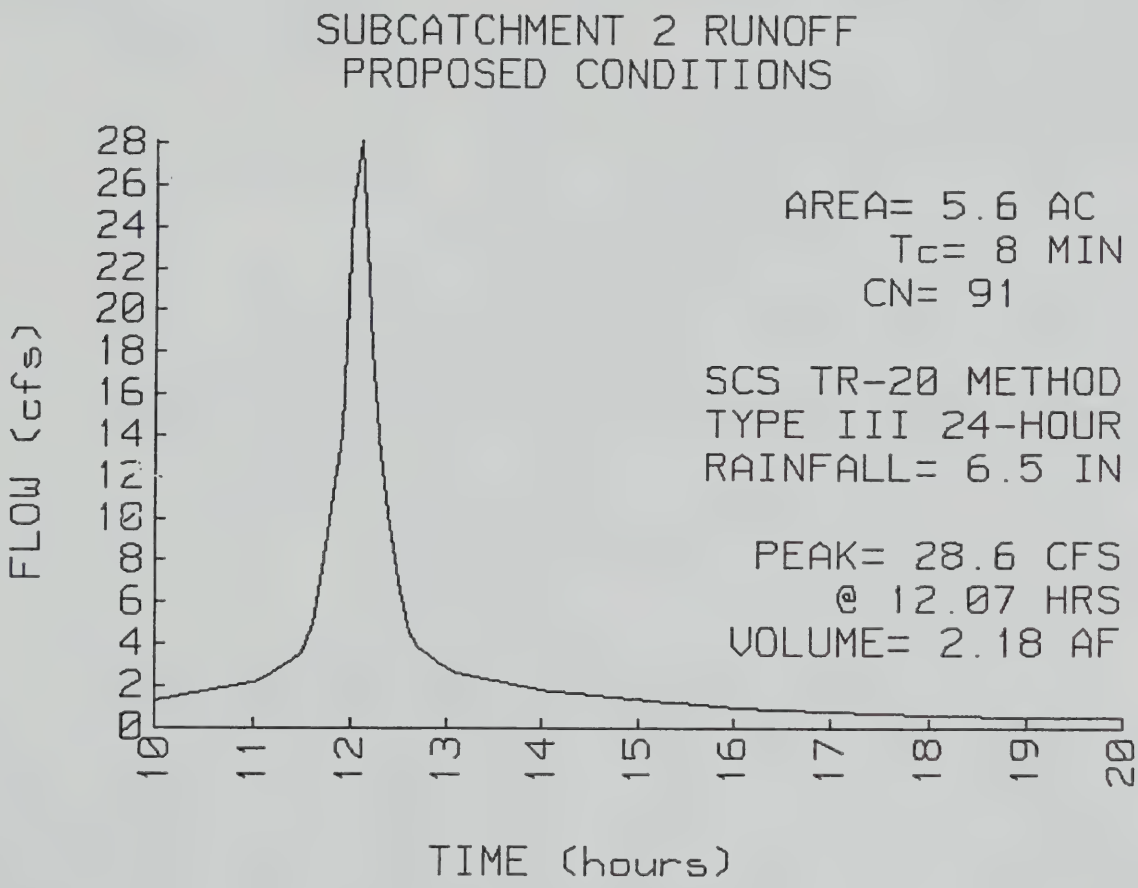
SUBCATCHMENT 2 **PROPOSED CONDITIONS** 100 YEAR STORM

ACRES	CN
5.60	91

WEIGHTED CN FROM TR-55

AREA= 5.60 AC Tc= 8 MIN

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.5 IN
PEAK= 28.6 CFS @ 12.07 HRS
VOLUME= 2.18 AF



SUBCATCHMENT 2 **PROPOSED CONDITIONS**

RUNOFF PEAK= 28.6 CFS @ 12.07 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.0	2.1
11.00	2.2	2.3	2.6	2.9	3.2	3.6	4.9	7.5	10.5	14.1
12.00	25.[illegible]	28.1	18.1	13.1	9.6	6.6	4.6	3.9	3.5	3.2
13.00	2.8	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.0	1.9
14.00	1.8	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4
15.00	1.4	1.3	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0
16.00	1.0	.9	.9	.9	.9	.9	.8	.8	.8	.8
17.00	.8	.7	.7	.7	.7	.7	.7	.6	.6	.6
18.00	.6	.6	.6	.6	.6	.6	.5	.5	.5	.5
19.00	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
20.00	.5									

POND 2 **DETENTION BASIN** 100 YEAR STORM

STARTING ELEV= 192.3 FT
FLOOD ELEV= 196.0 FT

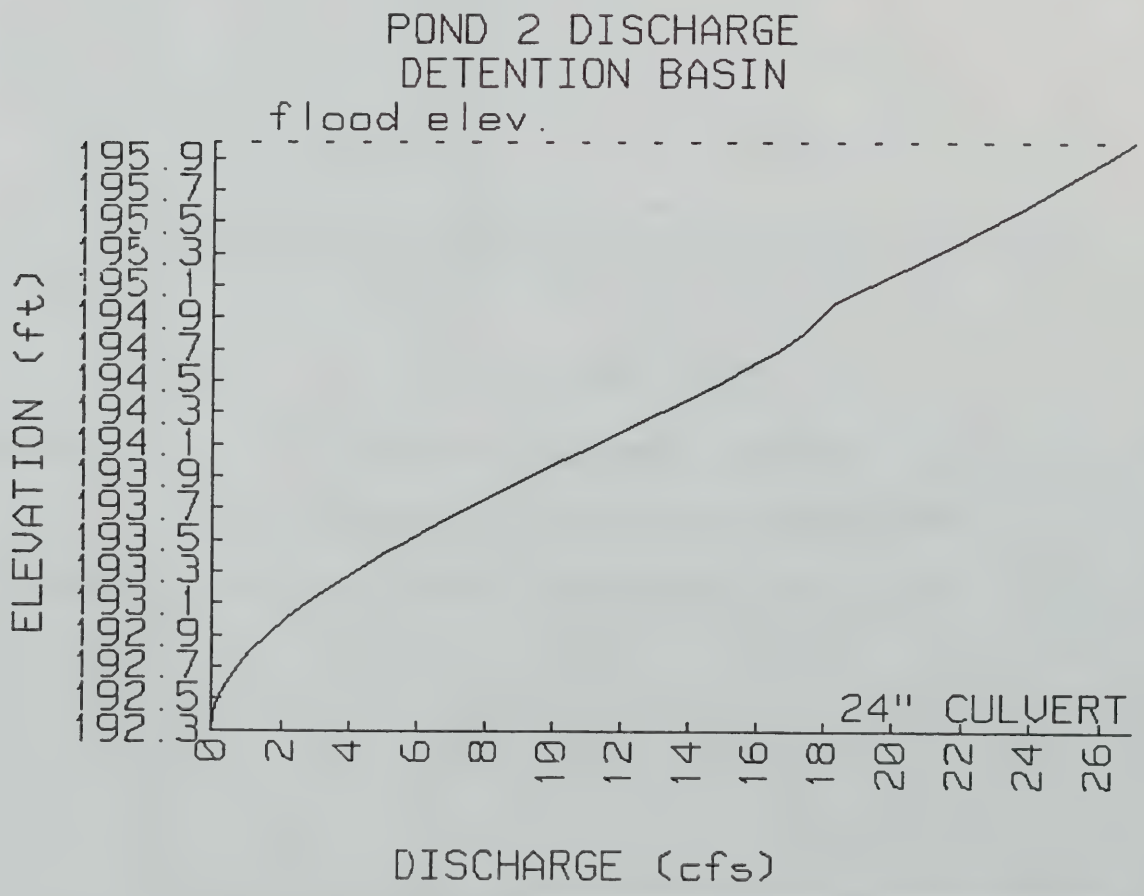
ELEVATION (FT)	CUM.STOR (AF)
192.3	0.00
193.0	.09
194.0	.24
196.0	.59

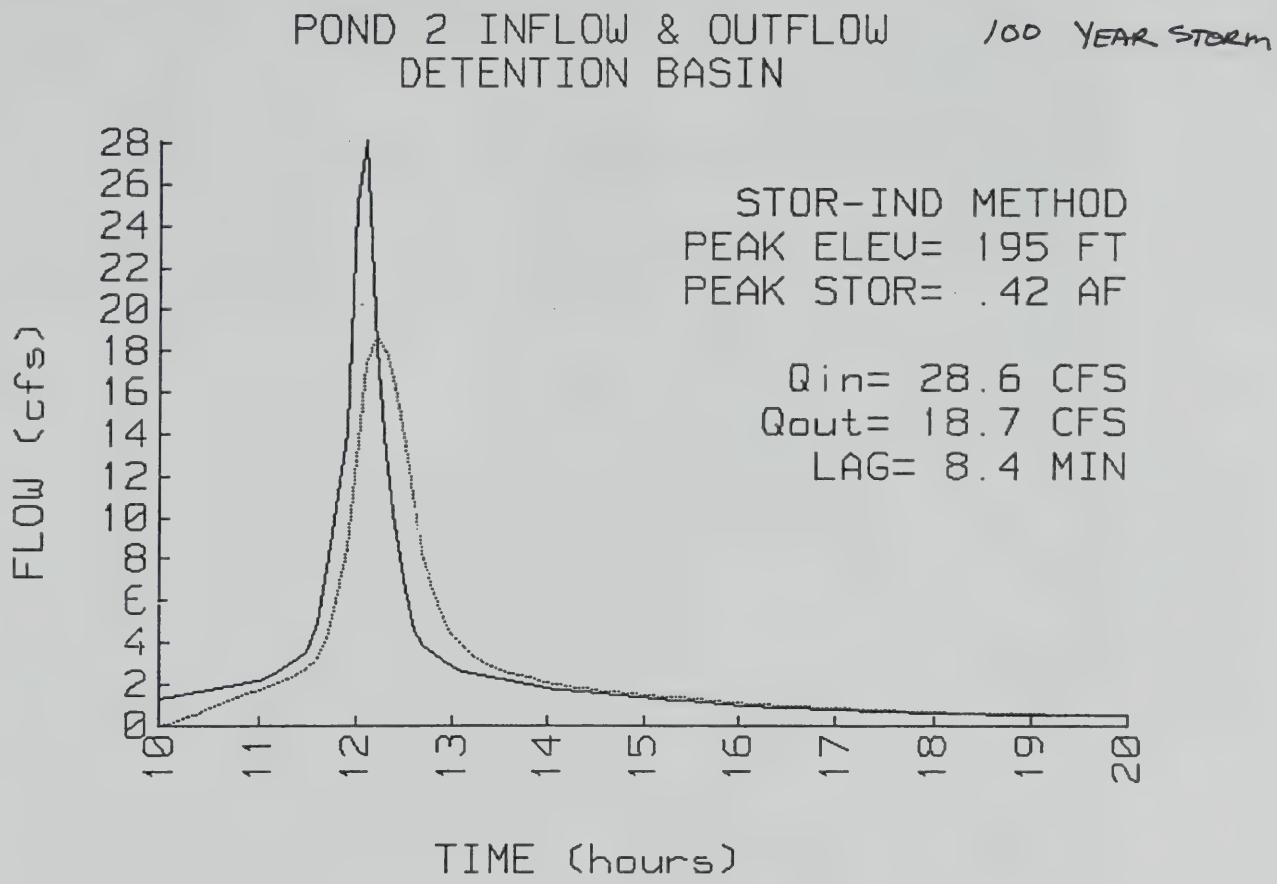
STOR-IND METHOD
PEAK ELEVATION= 195.0 FT
PEAK STORAGE = .42 AF
Qin = 28.6 CFS @ 12.07 HRS
Qout= 18.7 CFS @ 12.21 HRS
ATTEN= 35 % LAG= 8.4 MIN
IN/OUT= 2.18 / 2.14 AF

INVERT (FT)	OUTLET DEVICES
192.3	**24" CULVERT**
	n=.013 L=30' S=.005'/' Ke=.25 Cc=.9 Cd=.72

TOTAL DISCHARGE vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
192.3	0.0	0.0	.2	.4	.7	1.1	1.6	2.1	2.8	3.4
193.3	4.1	4.9	5.7	6.6	7.5	8.4	9.3	10.3	11.3	12.2
194.3	13.2	14.1	15.0	15.9	16.7	17.3	17.8	18.3	19.3	20.3
195.3	21.2	22.1	23.0	23.8	24.6	25.4	26.2	26.9		





POND 2 **DETENTION BASIN**

OUTFLOW PEAK= 18.7 CFS @ 12.21 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	.1	.2	.4	.6	.8	1.0	1.2	1.4	1.6
11.00	1.7	1.9	2.1	2.3	2.5	2.8	3.2	4.2	6.0	8.4
12.00	12.8	17.3	18.7	17.9	16.2	13.4	10.5	8.0	6.3	5.2
13.00	4.4	3.8	3.4	3.1	2.9	2.7	2.6	2.4	2.3	2.2
14.00	2.1	2.0	1.9	1.9	1.8	1.7	1.7	1.6	1.6	1.5
15.00	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.1
16.00	1.1	1.1	1.0	1.0	1.0	1.0	.9	.9	.9	.9
17.00	.8	.8	.8	.8	.8	.7	.7	.7	.7	.7
18.00	.7	.7	.6	.6	.6	.6	.6	.6	.6	.6
19.00	.6	.6	.5	.5	.5	.5	.5	.5	.5	.5
20.00	.5									

5.4 Massachusetts Natural Heritage Atlas Excerpts

5.4.A Estimated Habitats of Rare Wetlands Wildlife and Certified Vernal Pools (5 Quads)

ESTIMATED HABITATS OF RARE WETLANDS WILDLIFE AND CERTIFIED VERNAL POOLS

Produced by Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
Note: Intended for use ONLY with the MA Wetlands Protection Act regulations (310 CMR 10).

Scale 1:60,000
(1 inch = 5,000 feet)

See County Index Maps to locate adjacent quadrangles

WORCESTER NORTH QUAD

1994 EDITION

MAP OF ESTIMATED HABITATS
OF STATE-LISTED RARE WETLANDS WILDLIFE

Use only in reference to the Wetlands
Protection Act Regulations (310 CMR 10)

Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife

SHREWSBURY QUAD

Scale 1:60,000 (1 inch = 5,000 feet)
See County Index Maps to locate adjacent quadrangles

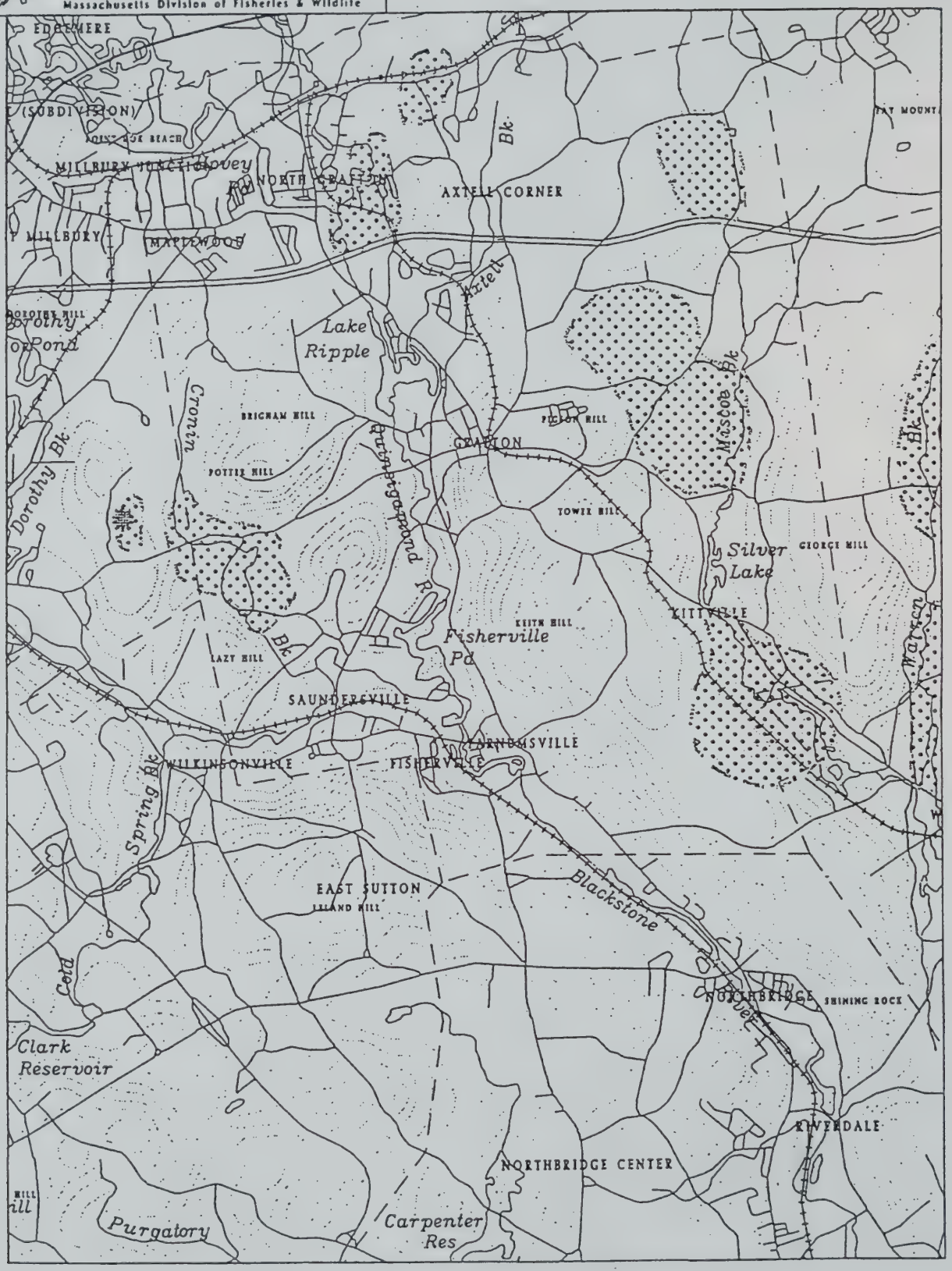
1992 EDITION

Scale 1:60,000 (1 inch = 5,000 feet)
See County Index Maps to locate adjacent quadrangles

1993 EDITION

MAP OF ESTIMATED HABITATS
OF STATE-LISTED RARE WETLANDS WILDLIFE

Use only in reference to the Wetlands
Protection Act Regulations (310 CMR 10)
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife



Scale 1:60,000 (1 inch = 5,000 feet)
See County Index Maps to locate adjacent quadrangles

1993 EDITION

MAP OF ESTIMATED HABITATS
OF STATE-LISTED RARE WETLANDS WILDLIFE

Use only in reference to the Wetlands
Protection Act Regulations (310 CMR 10)
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife

Scale 1:60,000 (1 inch = 5,000 feet)
See County Index Maps to locate adjacent quadrangles

1993 EDITION

5.4.B High Priority Sites of Rate Species Habitats and Exemplary Natural Communities (5 Quads)

HIGH PRIORITY SITES OF RARE SPECIES HABITATS AND EXEMPLARY NATURAL COMMUNITIES

Produced by Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
Note: These habitats NOT equivalent to SIGNIFICANT HABITATS as designated under MA Endangered Species Act, NOT for use with MA Wetlands ProtectionAct.

Scale 1:60,000
(1 inch = 5,000 feet)

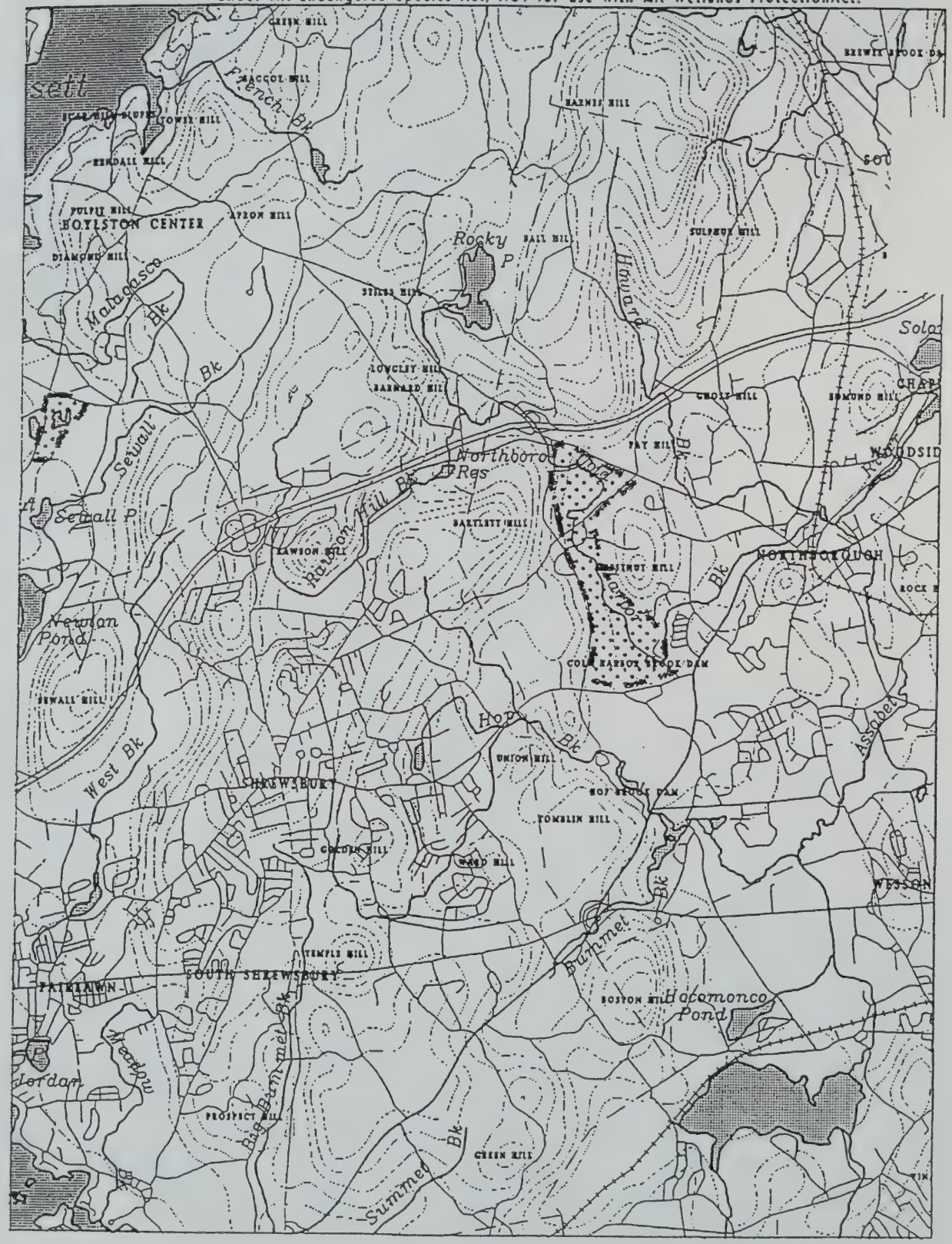
See County Index Maps to locate adjacent quadrangles

WORCESTER NORTH QUAD

1994 EDITION

HIGH PRIORITY SITES OF RARE SPECIES HABITATS AND EXEMPLARY NATURAL COMMUNITIES

Produced by Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
Note: These habitats NOT equivalent to SIGNIFICANT HABITATS as designated under MA Endangered Species Act, NOT for use with MA Wetlands ProtectionAct.



Scale 1:60,000
(1 inch = 5,000 feet)

See County Index Maps to locate adjacent quadrangles

SHREWSBURY QUAD

1994 EDITION

HIGH PRIORITY SITES OF RARE SPECIES HABITATS AND EXEMPLARY NATURAL COMMUNITIES

Produced by Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
Note: These habitats NOT equivalent to SIGNIFICANT HABITATS as designated under MA Endangered Species Act, NOT for use with MA Wetlands ProtectionAct.

Scale 1:60,000
(1 inch = 5,000 feet)

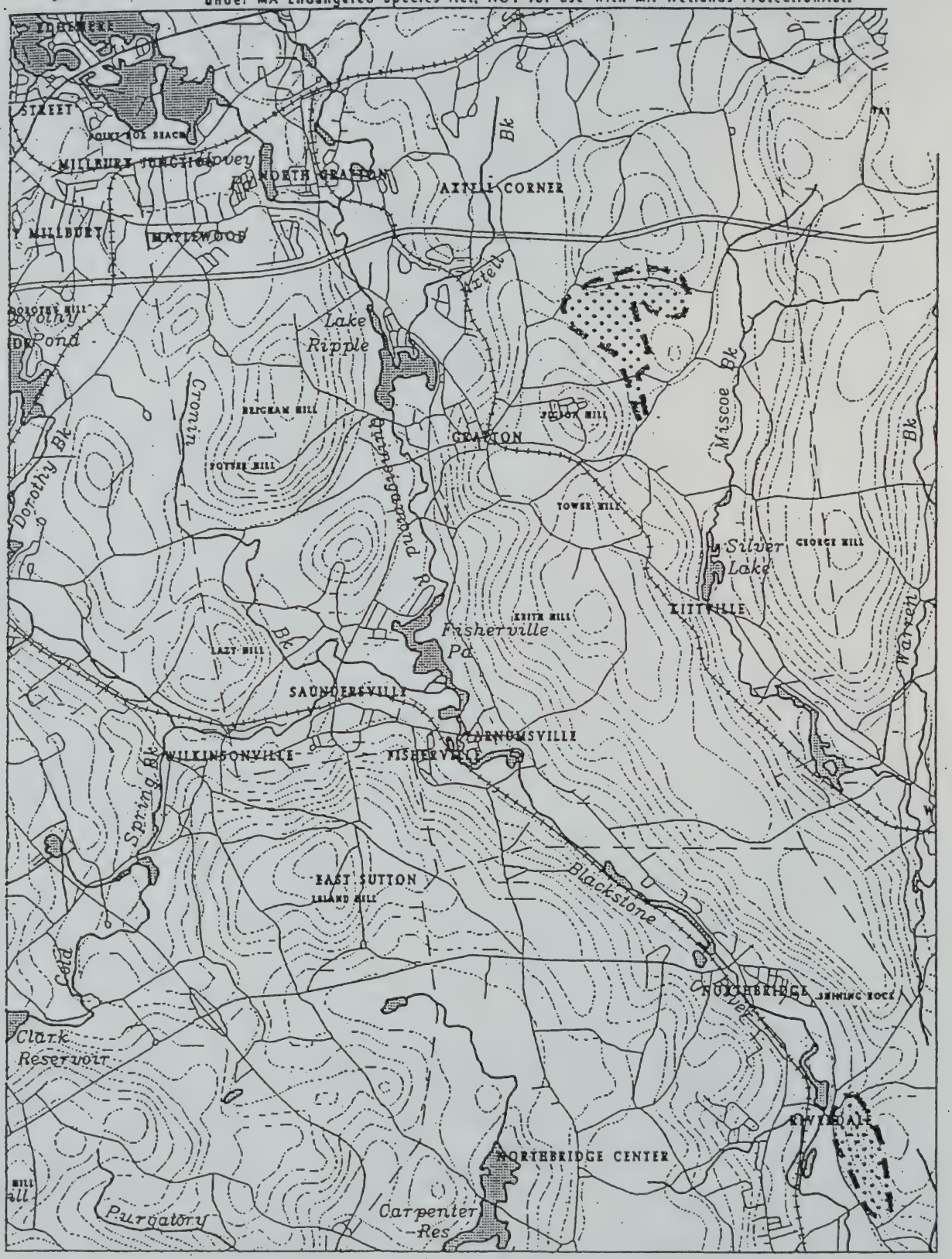
See County Index Maps to locate adjacent quadrangles

MARLBOROUGH QUAD

1994 EDITION

HIGH PRIORITY SITES OF RARE SPECIES HABITATS AND EXEMPLARY NATURAL COMMUNITIES

Produced by Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
Note: These habitats NOT equivalent to SIGNIFICANT HABITATS as designated under MA Endangered Species Act, NOT for use with MA Wetlands ProtectionAct.



Scale 1:60,000
(1 inch = 5,000 feet)

See County Index Maps to locate adjacent quadrangles

GRAFTON QUAD

1994 EDITION

HIGH PRIORITY SITES OF RARE SPECIES HABITATS AND EXEMPLARY NATURAL COMMUNITIES

Produced by Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
Note: These habitats NOT equivalent to SIGNIFICANT HABITATS as designated under MA Endangered Species Act, NOT for use with MA Wetlands ProtectionAct.

Scale 1:60,000
(1 inch = 5,000 feet)

See County Index Maps to locate adjacent quadrangles

FRAMINGHAM QUAD

1994 EDITION

SECTION 6.0

AIR QUALITY

Appendix: EIR Supplemental Air Quality Impact Analysis

This appendix describes the methodologies and results of the supplemental air quality analyses conducted to evaluate the proposed Worcester Commuter Rail Extension. It is broken down into the following sections:

1.0 Obtain Newly Available Data and Verify Existing Data;
2.0 Analyze the Regional Mobile Source Emission Impacts of Commuter Rail and Express Bus Alternatives;
3.0 Analyze the Emission Comparisons of Bus and Commuter Rail Operations;
4.0 Analyze the Localized Emission Impacts on Peak Hour Massachusetts Turnpike Operations;
5.0 Analyze the Localized Impacts of Worcester Layover Facility; and
6.0 Conduct Worst Case Intersection Analyses.

1.0 Obtain Newly Available Data and Verify Existing Data

This section describes the changes in the data components used for the air quality impact analysis performed for the Worcester Commuter Rail Extension Project. There are several assumptions that have changed since the original analysis was completed, which are outlined below.

The emission rates were generated using the EPA's Mobile5a Emissions Model based on Massachusetts input files provided by the DEP on July 14, 1994. There are several differences between these files and the input files used in the previous analysis:

- Addition of a Massachusetts specific VMT mix;
- Different Vehicle Age Distribution (resulting in an older fleet);
- California LEV Program is modelled;
- Winter temperature range is higher (35 to 45 opposed to 29 to 30 degrees Fahrenheit); and
- Enhanced I/M Program is in place for all forecast periods, with some specific differences from the previous Enhanced I/M Program.

The change in forecast years from 1995 and 2000 to 1996 and 2001 impacts the emission rates because 1996 is the year in which the new Enhanced Inspection and Maintenance (I/M) program becomes fully operational.

New locomotive emission data was obtained from the report, Locomotive Emission Study, prepared for the California Air Resources Board, by Booz, Allen and Hamilton Inc.

Updated Massachusetts Turnpike data was taken from the High Occupancy Vehicle Lane Feasibility Study, prepared for the Massachusetts Turnpike Authority by URS, Inc., dated April 1994. This data was then adjusted to reflect the years 1996 and 2001, and new speeds and level of service were generated using the Highway Capacity Software, written by FHWA.

CINCH traffic data was provided by Edwards and Kelcey, Inc. which was used as input for the EPA's CAL3QHC air quality program to analyze worst case intersections in each town.

2.0 Regional Mobile Source Emission Impacts of Commuter Rail and Express Bus Alternatives

This section describes the analysis procedures and results associated with the area-wide impacts of trip diversions to commuter rail or express bus. An analysis associated with the analysis of the impacts of a mode shift from automobile to the Worcester Commuter Rail Extension under a "build" scenario was conducted and compared to a no-build scenario in which these trips travel to downtown Boston via automobile for the years 1996 and 2001. The ridership data used in this analysis was based on a memorandum from Vijay Mahal of the Central Transportation Planning Staff (CTPS) to Jim Herlihy of Edwards and Kelcey, Inc., dated May 18, 1994. This quantified commuter rail trips attracted to the various proposed stations for the Worcester Commuter Rail Extension, not considering the possibility of a regional station. The air quality analysis assumes that these trips would otherwise be made by automobile in the absence of the commuter rail extension.

This analysis calculated the regional round trip emissions produced by vehicles which would travel from the various towns of trip origin into Boston and compares these emissions with those produced by trips to the various Worcester Commuter Rail stations necessary to access the rail service. The difference between the emissions produced by auto trips into Boston under a no-build scenario and the emissions produced by trips accessing the commuter rail stations under a build scenario is assumed to account for the regional air quality benefit of the commuter rail extension.

The estimated reduction in regional emissions for the proposed commuter rail basic and enhanced service options are identical, as there is no difference in ridership estimated by CTPS for these two options. In addition, the estimated reduction in regional emissions for the express bus alternative are also equal to the commuter rail reduction in emissions as bus ridership is assumed to be equal to the rail ridership.

A number of steps were involved in the calculation of the regional emission benefits. The CTPS data are based on person trips rather than vehicle trips. Therefore, a conversion to vehicle trips was made using regional vehicle occupancy rates provided by CTPS. The analysis assumes that the average vehicle occupancy for highway work trip travel is 1.2 and travel to park-and-ride facilities is 1.12.

The CTPS ridership projections have been assumed to consist entirely of new riders; no diversion from existing bus operations is assumed. The original analysis assumed that the existing bus riders would convert to the rail service. The ridership numbers forecasted for the Worcester and Millbury stations were approximately equal to the bus ridership. It was assumed that the emissions from auto trips to the Peter Pan bus stops were equivalent to those that would be produced by the same number of trips to the commuter rail stations. As a result, it was determined that there would be no air quality benefit from transferring bus riders to commuter rail and these ridership numbers were omitted. This updated analysis is based on a system in which the trips to all the proposed stations (with the exception of the possible regional station) are included.

Average travel distances between trip origins and downtown Boston for the no-build scenario and between trip origins and the proposed commuter rail or express bus stations in the build scenario were based on measurements of travel distances off of regional highway maps. Trips were assumed to originate from the town center and travel via primary and arterial roadways to their destination. All trips to downtown Boston were assumed to utilize the Massachusetts Turnpike from the nearest appropriate Turnpike entrance to its downtown terminus. Travel speeds were based on default speeds by highway functional class from the Federal Highway Administration's Highway Performance Monitoring System (HPMS), except for the section of the Turnpike located between Route 128 and downtown Boston. The vehicle speeds associated with this section were adjusted for both 1996 and 2001, to reflect the reduction in speed resulting from growth in VMT. The speed data were taken

from the High Occupancy Vehicle Lane Feasibility Study, prepared by URS Consultants, Inc., updated in April 1994.

By assuming use of the Massachusetts Turnpike for all trips, with its higher average travel speeds, the analysis provides a more conservative estimate of benefits due to the inverse relationship between speeds and emission rates. It is realized that not all trips are likely to utilize the Turnpike, thereby travelling at lower average speeds, thus producing emissions at higher rates. Diversion of these trips to commuter rail or express bus would result in even greater emission reduction benefits.

A further adjustment used in the calculation of regional VMT was made to account for the variation in the mode of access to the commuter rail stations. All park-and-ride trips were assumed to involve one trip out and one trip back to the town of origin. All kiss-and-ride trips were assumed to involve two round trips to the station to account for drop-offs. This has been reflected in both the total VMT and total emission calculations. In addition, for the kiss-and-ride trips it was assumed that they originated within the town in which the station was located.

The results of the analysis are shown in Table 2.1. Operation of this system would result in the reduction of the total daily regional vehicle miles of travel by 118,015 VMT in year 1996 and 126,614 in year 2001. This results in the following net reductions in daily pollutants:

- VOC: 114 kilograms in 1996 and 87 kilograms in 2001;
- NOX: 200 kilograms in 1996 and 165 kilograms in 2001;and
- CO: 1,584 kilograms in 1996 and 1,162 kilograms in 2001.

3.0 Emission Comparisons of Bus and Commuter Rail Operations

This section compares the emissions associated with the Expanded and Basic commuter rail services to the bus service alternative. Comparisons are made in 1996 and 2001. The locomotive emission factors are held constant for these two time periods because data are not available as to how locomotive emissions may improve over time. The Mobile5a generated factors for heavy duty diesel vehicles are used for the bus calculations, consistent with conventional practice. As can be seen by the results presented in Table 3.1, the largest difference occurs in the emissions for oxides of nitrogen. Those associated with the rail service are significantly larger than those associated with the bus alternative.

The following subsections define the assumptions used for these analyses as well as present the results.

Commuter Rail Assumptions

- The locomotive emission factors are based on the 16-645E3B engine, manufactured by EMD, which was tested in June 1978. This engine represents the proposed locomotives for operation on the Worcester Extension. The emission factors themselves are based on the report, Locomotive Emission Study, prepared for the California Air Resources Board by Booz, Allen & Hamilton Inc.

- The locomotive emission factors are adjusted to account for typical service consisting of local and express segments. Non-stop route segments from Worcester to Framingham and Framingham to Boston are categorized as express. The engine emission factors are adjusted to reflect specific profiles provided by the Locomotive Emissions Study. (Industry Standard Profile for EMD Medium Road Duty for express service and Local Service Throttle Profile for local service).

Table 2.1
Worcester Commuter Rail Extension Study
Comparison of Regional Daily Emissions

	NO-BUILD TOWN CTR TO BOSTON		BUILD TOWN CTR TO STATION		NET REDUCTION	
	1996	2001	1996	2001	1996	2001
VMT:	137,157	147,198	19,142	20,584	118,015	126,614
VOC Emissions (KG):	133.35	101.19	19.57	14.09	113.78	87.10
NOx Emissions (KG):	230.53	190.25	30.87	25.68	199.66	164.57
CO Emissions (KG):	1,853.67	1,339.75	269.34	177.53	1584.34	1162.21

* VOC and NOX emission rates are based on summer conditions. The CO emission rate is based on winter conditions.
** No Regional Station Modelled.

Table 3.1
Comparison of Commuter Rail Service and Bus Service
Years 1996 and 2001

	Expanded Commuter Rail Service Alternative		Expanded Service Bus Alternative	
	1996	2001	1996	2001
VOC(HC) IN KG:	9.38	9.38	9.05	9.12
NOx IN KG:	322.76	322.76	70.68	55.78
CO IN KG:	33.11	33.11	41.98	44.64

	Basic Commuter Rail Service Alternative		Basic Service Bus Alternative	
	1996	2001	1996	2001
VOC(HC) IN KG:	6.13	6.13	7.47	7.56
NOx IN KG:	210.21	210.21	58.54	46.23
CO IN KG:	21.76	21.76	34.72	37.06

* Rail emission rates are based on tests conducted in June 1978 and are held constant from 1996 to 2001.
* VOC and NOx Bus emissions are based on summer conditions; CO emissions are based on winter conditions.

- The extended service that is included in the calculations consists only of new service. For example, existing service to Framingham which extends its route to include the additional stations only contributes the incremental pollutants emitted between Framingham and Worcester. Whereas entirely new trains added to the schedule account for additional emissions between Framingham and Boston as well as between Framingham and Worcester. These calculations are based upon the schedule provided by Edwards and Kelcey as well as the Framingham Line Commuter Rail Schedule, dated April 11, 1994.

- The above explanations apply to both the Basic and Expanded commuter rail alternatives.

Bus Alternative Assumptions

- The Bus Alternative is assumed to generate the same level of demand as the commuter rail extension, and will originate service at each of the proposed commuter rail stations. Peak period service assumes buses departing from each station with express service to Boston; off-peak trips consist of buses serving 3 stations grouped as follows: Ashland-Southborough-Westborough; and Grafton-Millbury-Worcester.

- The emission rates for the buses are based on the EPA's Mobile5a Heavy Duty Diesel Vehicle(HDDV) rates for both 1996 and 2001. The input characteristics are identical to those described in Sections 1 and 2.

- As provided by Edwards and Kelcey, Inc., there are 57 inbound and 59 outbound peak period buses in 1996 and 59 inbound and 61 outbound in 2001 for both expanded and basic service. Off peak service consists of 12 inbound and 12 outbound in 1996 and 2001 for basic service and 24 inbound and 24 outbound in 1996 and 2001 for expanded service.

- One dead head (empty) bus is assumed to exist for each station, both in the AM peak and the PM peak.

- Bus mileage (VMT) is calculated based on the distances calculated for the auto emission analysis in Section 2, with adjustments made for the off peak service to multiple stations.

Analysis Results

The results of this analysis are shown in Table 3.1. In both the expanded and basic service alternatives the locomotive NOx emissions far exceed that of the buses (by more than a factor of 3 in basic service and more than a factor of 4 in expanded service). The VOC emissions are very close, with the rail alternative being higher in the expanded service and the bus alternative being higher under the basic service scenario. The CO emissions are greater by the buses in both scenarios.

4.0 Localized Emission Impacts on Peak Hour Massachusetts Turnpike Operations

This section analyzes the emission and speed impacts of the Worcester Commuter Rail Extension on the peak hour operations of the Massachusetts Turnpike. Data for this analysis is taken from the High Occupancy Vehicle Lane Feasibility Study, prepared for the Massachusetts Turnpike Authority by URS Consultants, Inc., August 1993 (revised April 1994). The data was used and adjusted as follows:

- 1996 and 2001 traffic volumes for the AM and PM peak hours were determined based on the 1990 base year data and the 2020 forecast.

- Speeds and Levels of Service for the turnpike segments were calculated by the FHWA's Highway Capacity Software, based on the Highway Capacity Manual. The assumptions are similar to those used by URS for the HOV study analysis.

- The turnpike segments were used as defined in the URS study.

The Worcester Commuter Rail ridership forecasts developed by CTPS suggest that in 1996 there will be 2,137 inbound person trips with 2,299 in 2001. These numbers were adjusted as follows:

- One half of the trips are assumed to be from previous Mass. Turnpike users;
- One half of the previous Turnpike users are assumed to travel inbound during the peak period; and
- The occupancy rate is 1.2.

These adjustments provided a reduction of 445 vehicle trips inbound in 1996 and a reduction of 479 in 2001. (The same number of trips are subtracted from the PM westbound traffic.) Tables 4.1 and 4.2 provide the speed reductions and Level of Service changes associated with these reductions(volume reduction resulting in lower VMT) for both 1996 and 2001. The number of failing segments (LOS=F) went from 3 to 2 in 1996 and from 7 to 2 in 2001.

The analysis completed in Section 2 accounted for the reduction in VMT resulting from the Worcester Commuter Rail Extension, however it did not cover the decrease in emissions associated with increased speeds for the remaining Turnpike users. Tables 4.3 and 4.4 break down the emission calculations. Both of these tables are split into three pages, which provide the No-Build, Build, and Build with No-Build emission rates and speeds. Comparison of the No-Build and Build results show the total net emission benefits provided by the Worcester Commuter Rail Extension. Comparison of the two Build results show the emission benefits associated only with the speed reductions. Table 4.5 shows a summary comparison of the two Build results. To determine the emission benefits associated with the speed reductions, the No-Build speed emission factors were applied to the Build VMT to compute total emissions. These figures were then compared to the total emissions of the Build scenario.

The results represent daily peak period emission reductions (both AM and PM) and are as follows:

- 1996 VOC net reduction of 47.7 KG
- 1996 NOx net reduction of 1.8 KG
- 1996 CO net reduction of 768.6 KG

- 2001 VOC net reduction of 28.4 KG
- 2001 NOx net reduction of 0.67 KG
- 2001 CO net reduction of 532.5 KG

5.0 Localized Impacts of Worcester Layover Facility

This section analyzes the possibility of localized emission impacts associated with the Worcester layover facility for the Worcester Commuter Rail Extension.

The passenger train layover facility is proposed to be located adjacent to the existing Amtrak Station in Worcester, directly east of I-290. The layover facility would consist of four sets of tracks to provide

Table 4.1
Worcester Commuter Rail Extension Study
Calculation of Speed Changes on Mass. Turnpike Extension
Year 1996

EASTBOUND - AM

Turnpike Section	Distance (miles)	1996 No-Build Condition Lanes	Volume	VMT	LOS	Lane Volume	Speed	1996 Build Conditions: Worcester Commuter Rail Extension Volume	VMT	LOS	Lane Volume	Speed
Rt. 128 Exit to Toll #15	0.55	3	3,094	1,702	C	1,031	52	2,649	1,457	B	883	53
Toll #15 to Rt. 128 Entrance	0.04	3	3,094	124	C	1,031	52	2,649	106	B	883	53
Rt. 128 to West Newton	1.94	3	5,522	10,713	E	1,841	30	5,077	9,849	E	1,692	40
West Newton to Newton Corner	2.06	3	6,697	13,796	F	2,232	5	6,252	12,879	F	2,084	18
Newton Corner Exit to Entrance	0.54	3	5,628	3,039	F	1,876	28	5,183	2,799	E	1,728	39
Newton Corner to Allston-Brighton	2.74	4	7,215	19,770	E	1,804	33	6,770	18,550	E	1,693	40
Allston-Brighton Exit to Toll #19	0.35	4	5,405	1,892	D	1,351	48	4,960	1,736	C	1,240	50
Toll #19 to A-B Entrance	0.19	4	5,405	1,027	D	1,351	48	4,960	942	C	1,240	50
Allston-Brighton to Pru-Copley	2.20	4	7,125	15,674	E	1,781	35	6,679	14,695	E	1,670	40
Pru-Copley to Kneeland	0.92	3	4,881	4,491	E	1,627	42	4,436	4,081	D	1,479	46

WESTBOUND - PM

Turnpike Section	Distance (miles)	1996 No-Build Condition Lanes	Volume	VMT	LOS	Lane Volume	Speed	1996 Build Conditions: WorceWith Worcester Extension Volume	VMT	LOS	Lane Volume	Speed
Kneeland to Arlington	0.48	3	3,836	1,841	C	1,279	49	3,390	1,627	C	1,130	51
Arlington to Clarendon	0.27	3	4,644	1,254	D	1,548	44	4,199	1,134	D	1,400	47
Clarendon to Copley	0.19	3	4,813	915	D	1,604	43	4,368	830	D	1,456	46
Copley to Mass Ave	0.51	4	5,601	2,856	D	1,400	47	5,156	2,629	C	1,289	49
Mass Ave to Allston-Brighton	1.68	4	6,122	10,285	D	1,531	45	5,677	9,537	D	1,419	47
Allston-Brighton to Toll #19	0.22	4	4,705	1,035	C	1,176	50	4,260	937	C	1,065	51
Toll #19 to A-B Entrance	0.28	4	4,705	1,318	C	1,176	50	4,260	1,193	C	1,065	51
Allston-Brighton to Newton Corner	2.30	4	6,450	14,835	D	1,613	43	6,005	13,811	D	1,501	45
Newton Corner Exit to Entrance	0.36	3	4,942	1,779	E	1,647	42	4,497	1,619	D	1,499	45
Newton Corner to West Newton	2.12	3	6,081	12,891	F	2,027	22	5,635	11,947	F	1,878	28
West Newton to Rt. 128 Exit	1.68	3	5,464	9,180	E	1,821	32	5,019	8,432	E	1,673	40
Rt. 128 Exit to Toll #15	0.07	3	2,857	200	B	952	53	2,411	169	B	804	54
Toll #15 to Rt. 128 Entrance	0.47	3	2,857	1,343	B	952	53	2,411	1,133	B	804	54

Table 4.2
Worcester Commuter Rail Extension Study
Calculation of Speed Changes on Mass. Turnpike Extension
Year 2001

EASTBOUND - AM

		2001 No-Build Condition					2001 Build Conditions: WorceWith Worcester Extension				
Turnpike Section	Distance (miles)	Lanes	Volume	VMT	LOS	Lane Volume	Speed	Volume	VMT	LOS	Lane Volume	Speed
Rt. 128 Exit to Toll #15	0.55	3	3,249	1,787	C	1,083	51	2,770	1,523	B	923	53
Toll #15 to Rt. 128 Entrance	0.04	3	3,249	130	C	1,083	51	2,770	111	B	923	53
Rt. 128 to West Newton	1.94	3	5,810	11,271	F	1,937	27	5,331	10,341	E	1,777	36
West Newton to Newton Corner	2.06	3	6,976	14,371	F	2,325	5	6,497	13,384	F	2,166	10
Newton Corner Exit to Entrance	0.54	3	5,927	3,200	F	1,976	25	5,448	2,942	E	1,816	32
Newton Corner to Allston-Brighton	2.74	4	7,595	20,809	F	1,899	28	7,116	19,497	E	1,779	35
Allston-Brighton Exit to Toll #19	0.35	4	5,782	2,024	D	1,446	46	5,303	1,856	D	1,326	48
Toll #19 to A-B Entrance	0.19	4	5,782	1,099	D	1,446	46	5,303	1,008	D	1,326	48
Allston-Brighton to Pru-Copley	2.20	4	7,623	16,770	F	1,906	28	7,144	15,716	E	1,786	35
Pru-Copley to Kneeland	0.92	3	5,272	4,850	E	1,757	38	4,793	4,409	D	1,598	43

WESTBOUND - PM

		2001 No-Build Condition					2001 Build Conditions: Worcester Commuter Rail Extension				
Turnpike Section	Distance (miles)	Lanes	Volume	VMT	LOS	Lane Volume	Speed	Volume	VMT	LOS	Lane Volume	Speed
Kneeland to Arlington	0.48	3	4,221	2,026	D	1,407	47	3,742	1,796	C	1,247	49
Arlington to Clarendon	0.27	3	5,036	1,360	E	1,679	40	4,557	1,230	D	1,519	45
Clarendon to Copley	0.19	3	5,210	990	E	1,737	39	4,731	899	D	1,577	43
Copley to Mass Ave	0.51	4	6,024	3,072	D	1,506	45	5,545	2,828	D	1,386	48
Mass Ave to Allston-Brighton	1.68	4	6,561	11,023	E	1,640	42	6,082	10,218	D	1,521	45
Allston-Brighton to Toll #19	0.22	4	5,044	1,110	C	1,261	49	4,565	1,004	C	1,141	51
Toll #19 to A-B Entrance	0.28	4	5,044	1,412	C	1,261	49	4,565	1,278	C	1,141	51
Allston-Brighton to Newton Corner	2.30	4	6,809	15,662	E	1,702	40	6,331	14,560	D	1,583	43
Newton Corner Exit to Entrance	0.36	3	5,227	1,882	E	1,742	38	4,748	1,709	D	1,583	43
Newton Corner to West Newton	2.12	3	6,346	13,453	F	2,115	15	5,867	12,437	F	1,956	26
West Newton to Rt. 128 Exit	1.68	3	5,706	9,587	F	1,902	28	5,227	8,782	E	1,742	38
Rt. 128 Exit to Toll #15	0.07	3	3,015	211	C	1,005	52	2,536	178	B	845	54
Toll #15 to Rt. 128 Entrance	0.47	3	3,015	1,417	C	1,005	52	2,536	1,192	B	845	54

Table 4.3
Worcester Commuter Rail Extension Project
Emission Calculations of
Mass. Turnpike Extension - 1996

EASTBOUND - AM

Turnpike Section	1996 No-Build Condition Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Rt. 128 Exit to Toll #15	3,094	1,702	52	0.81	1.87	10.48	1,378.32	3,182.06	17,833.12
Toll #15 to Rt. 128 Entrance	3,094	124	52	0.81	1.87	10.48	100.24	231.42	1,296.95
Rt. 128 to West Newton	5,522	10,713	30	1.16	1.57	16.48	12,427.14	16,819.49	176,551.04
West Newton to Newton Corner	6,697	13,796	5	4.44	1.94	68.57	61,255.18	26,764.65	946,006.22
Newton Corner Exit to Entrance	5,628	3,039	28	1.21	1.56	17.65	3,677.17	4,740.81	53,637.99
Newton Corner to Allston-Brighton	7,215	19,770	33	1.08	1.58	14.99	21,351.40	31,236.30	296,349.49
Allston-Brighton Exit to Toll #19	5,405	1,892	48	0.82	1.66	10.47	1,551.15	3,140.14	19,805.60
Toll #19 to A-B Entrance	5,405	1,027	48	0.82	1.66	10.47	842.06	1,704.65	10,751.61
Allston-Brighton to Pru-Copley	7,125	15,674	35	1.04	1.59	14.14	16,301.29	24,922.17	221,634.86
Pru-Copley to Kneeland	4,881	4,491	42	0.91	1.62	11.85	4,086.66	7,275.15	53,216.37
SUBTOTALS:							122,970.60	120,016.83	1,797,083.24

WESTBOUND - PM

Turnpike Section	1996 No-Build Condition Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Kneeland to Arlington	3,836	1,841	49	0.81	1.71	10.47	1,491.31	3,148.33	19,276.59
Arlington to Clarendon	4,644	1,254	44	0.87	1.63	11.34	1,090.94	2,043.95	14,219.86
Clarendon to Copley	4,813	915	43	0.89	1.62	11.59	813.93	1,481.53	10,599.37
Copley to Mass Ave	5,601	2,856	47	0.83	1.65	10.67	2,370.81	4,713.05	30,477.71
Mass Ave to Allston-Brighton	6,122	10,285	45	0.86	1.64	11.11	8,845.48	16,868.13	114,271.32
Allston-Brighton to Toll #19	4,705	1,035	50	0.81	1.76	10.47	838.50	1,821.93	10,838.42
Toll #19 to A-B Entrance	4,705	1,318	50	0.81	1.76	10.47	1,067.18	2,318.82	13,794.35
Allston-Brighton to Newton Corner	6,450	14,835	43	0.89	1.62	11.59	13,203.56	24,033.45	171,942.98
Newton Corner Exit to Entrance	4,942	1,779	42	0.91	1.62	11.85	1,619.15	2,882.44	21,084.49
Newton Corner to West Newton	6,081	12,891	22	1.43	1.55	22.43	18,433.86	19,980.75	289,140.83
West Newton to Rt. 128 Exit	5,464	9,180	32	1.1	1.58	15.45	10,097.75	14,504.04	141,827.48
Rt. 128 Exit to Toll #15	2,857	200	53	0.81	1.92	10.49	161.97	383.94	2,097.67
Toll #15 to Rt. 128 Entrance	2,857	1,343	53	0.81	1.92	10.49	1,087.55	2,577.89	14,084.39
SUBTOTALS:							61,121.99	96,758.24	853,655.46
TOTALS:							184,092.59	216,775.07	2,650,738.71

Table 4.3
Worcester Commuter Rail Extension Project
Emission Calculations of
Mass. Turnpike Extension - 1996

EASTBOUND - AM

1996
Build Conditions: Worcester Commuter Rail Extension

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Rt. 128 Exit to Toll #15	2,649	1,457	53	0.81	1.92	10.49	1,179.98	2,797.00	15,281.51
Toll #15 to Rt. 128 Entrance	2,649	106	53	0.81	1.92	10.49	85.82	203.42	1,111.38
Rt. 128 to West Newton	5,077	9,849	40	0.94	1.61	12.42	9,258.38	15,857.44	122,328.86
West Newton to Newton Corner	6,252	12,879	18	1.68	1.56	26.53	21,636.86	20,091.37	341,682.05
Newton Corner Exit to Entrance	5,183	2,799	39	0.96	1.60	12.72	2,686.62	4,477.71	35,597.77
Newton Corner to Allston-Brighton	6,770	18,550	40	0.94	1.61	12.42	17,436.95	29,865.41	230,390.27
Allston-Brighton Exit to Toll #19	4,960	1,736	50	0.81	1.76	10.47	1,406.02	3,055.06	18,174.13
Toll #19 to A-B Entrance	4,960	942	50	0.81	1.76	10.47	763.27	1,658.46	9,865.96
Allston-Brighton to Pru-Copley	6,679	14,695	40	0.94	1.61	12.42	13,813.17	23,658.72	182,510.16
Pru-Copley to Kneeland	4,436	4,081	46	0.84	1.64	10.88	3,428.24	6,693.24	44,403.90
SUBTOTALS:							71,695.31	108,357.82	1,001,346.00

WESTBOUND - PM

1996
Build Conditions: Worcester Commuter Rail Extension

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Kneeland to Arlington	3,390	1,627	51	0.81	1.81	10.48	1,318.22	2,945.64	17,055.43
Arlington to Clarendon	4,199	1,134	47	0.83	1.65	10.67	941.01	1,870.69	12,097.11
Clarendon to Copley	4,368	830	46	0.84	1.64	10.88	697.15	1,361.10	9,029.72
Copley to Mass Ave	5,156	2,629	49	0.81	1.71	10.47	2,129.76	4,496.17	27,529.15
Mass Ave to Allston-Brighton	5,677	9,537	47	0.83	1.65	10.67	7,916.12	15,736.87	101,765.10
Allston-Brighton to Toll #19	4,260	937	51	0.81	1.81	10.48	759.17	1,696.41	9,822.30
Toll #19 to A-B Entrance	4,260	1,193	51	0.81	1.81	10.48	966.21	2,159.07	12,501.11
Allston-Brighton to Newton Corner	6,005	13,811	45	0.86	1.64	11.11	11,877.87	22,650.83	153,445.55
Newton Corner Exit to Entrance	4,497	1,619	45	0.86	1.64	11.11	1,392.35	2,655.17	17,987.17
Newton Corner to West Newton	5,635	11,947	28	1.21	1.56	17.65	14,455.83	18,637.27	210,863.96
West Newton to Rt. 128 Exit	5,019	8,432	40	0.94	1.61	12.42	7,925.91	13,575.23	104,723.23
Rt. 128 Exit to Toll #15	2,411	169	54	0.80	1.97	10.50	135.04	332.54	1,772.45
Toll #15 to Rt. 128 Entrance	2,411	1,133	54	0.80	1.97	10.50	906.72	2,232.80	11,900.71
SUBTOTALS:							51,421.36	90,349.78	690,492.98
TOTALS:							123,116.68	198,707.60	1,691,838.97

Table 4.3
Worcester Commuter Rail Extension Project
Emission Calculations of
Mass. Turnpike Extension - 1996

EASTBOUND - AM

1996
Build Conditions: Worcester Extension with No-Build Speeds and Emission Factors

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Rt. 128 Exit to Toll #15	2,649	1,457	52	0.81	1.87	10.48	1,179.98	2,724.16	15,266.94
Toll #15 to Rt. 128 Entrance	2,649	106	52	0.81	1.87	10.48	85.82	198.12	1,110.32
Rt. 128 to West Newton	5,077	9,849	30	1.16	1.57	16.48	11,425.24	15,463.47	162,317.20
West Newton to Newton Corner	6,252	12,879	5	4.44	1.94	68.57	57,183.13	24,985.42	883,118.67
Newton Corner Exit to Entrance	5,183	2,799	28	1.21	1.56	17.65	3,386.27	4,365.76	49,394.71
Newton Corner to Allston-Brighton	6,770	18,550	33	1.08	1.58	14.99	20,033.94	29,308.91	278,063.62
Allston-Brighton Exit to Toll #19	4,960	1,736	48	0.82	1.66	10.47	1,423.38	2,881.48	18,174.13
Toll #19 to A-B Entrance	4,960	942	48	0.82	1.66	10.47	772.69	1,564.23	9,865.96
Allston-Brighton to Pru-Copley	6,679	14,695	35	1.04	1.59	14.14	15,282.65	23,364.83	207,785.32
Pru-Copley to Kneeland	4,436	4,081	42	0.91	1.62	11.85	3,713.93	6,611.61	48,362.71
SUBTOTALS:							114,487.02	111,467.99	1,673,459.58

WESTBOUND - PM

1996
Build Conditions: Worcester Extension with No-Build Speeds and Emission Factors

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Kneeland to Arlington	3,390	1,627	49	0.81	1.71	10.47	1,318.22	2,782.90	17,039.15
Arlington to Clarendon	4,199	1,134	44	0.87	1.63	11.34	986.36	1,848.01	12,856.72
Clarendon to Copley	4,368	830	43	0.89	1.62	11.59	738.64	1,344.50	9,618.97
Copley to Mass Ave	5,156	2,629	47	0.83	1.65	10.67	2,182.35	4,338.41	28,055.02
Mass Ave to Allston-Brighton	5,677	9,537	45	0.86	1.64	11.11	8,202.25	15,641.50	105,961.59
Allston-Brighton to Toll #19	4,260	937	50	0.81	1.76	10.47	759.17	1,649.55	9,812.93
Toll #19 to A-B Entrance	4,260	1,193	50	0.81	1.76	10.47	966.21	2,099.42	12,489.18
Allston-Brighton to Newton Corner	6,005	13,811	43	0.89	1.62	11.59	12,292.22	22,374.60	160,075.06
Newton Corner Exit to Entrance	4,497	1,619	42	0.91	1.62	11.85	1,473.30	2,622.79	19,185.23
Newton Corner to West Newton	5,635	11,947	22	1.43	1.55	22.43	17,084.16	18,517.80	267,970.46
West Newton to Rt. 128 Exit	5,019	8,432	32	1.10	1.58	15.45	9,275.00	13,322.28	130,271.65
Rt. 128 Exit to Toll #15	2,411	169	53	0.81	1.92	10.49	136.73	324.10	1,770.76
Toll #15 to Rt. 128 Entrance	2,411	1,133	53	0.81	1.92	10.49	918.05	2,176.13	11,889.38
SUBTOTALS:							56,332.66	89,041.98	786,996.11
TOTALS:							170,819.69	200,509.97	2,460,455.68

Table 4.4
Worcester Commuter Rail Extension Project
Emission Calculations of
Mass. Turnpike Extension - 2001

EASTBOUND - AM

Turnpike Section	2001 No-Build Condition Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Rt. 128 Exit to Toll #15	3,249	1,787	51	0.54	1.39	5.83	964.81	2,483.49	10,416.35
Toll #15 to Rt. 128 Entrance	3,249	130	51	0.54	1.39	5.83	70.17	180.62	757.55
Rt. 128 to West Newton	5,810	11,271	27	0.83	1.21	11.97	9,354.62	13,637.46	134,909.37
West Newton to Newton Corner	6,976	14,371	5	2.71	1.51	43.74	38,945.67	21,700.35	628,591.72
Newton Corner Exit to Entrance	5,927	3,200	25	0.87	1.21	13.11	2,784.28	3,872.39	41,956.28
Newton Corner to Allston-Brighton	7,595	20,809	28	0.81	1.21	11.46	16,855.41	25,179.07	238,472.85
Allston-Brighton Exit to Toll #19	5,782	2,024	46	0.57	1.27	6.15	1,153.57	2,570.24	12,446.44
Toll #19 to A-B Entrance	5,782	1,099	46	0.57	1.27	6.15	626.23	1,395.27	6,756.64
Allston-Brighton to Pru-Copley	7,623	16,770	28	0.81	1.21	11.46	13,583.37	20,291.20	192,179.48
Pru-Copley to Kneeland	5,272	4,850	38	0.65	1.24	7.86	3,152.40	6,013.81	38,119.78
SUBTOTALS:							87,490.52	97,323.90	1,304,606.46

WESTBOUND - PM

Turnpike Section	2001 No-Build Condition Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Kneeland to Arlington	4,221	2,026	47	0.56	1.28	5.98	1,134.73	2,593.66	12,117.25
Arlington to Clarendon	5,036	1,360	40	0.63	1.25	7.37	856.66	1,699.73	10,021.59
Clarendon to Copley	5,210	990	39	0.64	1.24	7.61	633.53	1,227.46	7,533.04
Copley to Mass Ave	6,024	3,072	45	0.58	1.27	6.33	1,781.89	3,901.72	19,447.15
Mass Ave to Allston-Brighton	6,561	11,023	42	0.61	1.25	6.92	6,724.11	13,778.92	76,280.10
Allston-Brighton to Toll #19	5,044	1,110	49	0.55	1.32	5.82	610.32	1,464.76	6,458.27
Toll #19 to A-B Entrance	5,044	1,412	49	0.55	1.32	5.82	776.77	1,864.24	8,219.62
Allston-Brighton to Newton Corner	6,809	15,662	40	0.63	1.25	7.37	9,866.94	19,577.25	115,427.50
Newton Corner Exit to Entrance	5,227	1,882	38	0.65	1.24	7.86	1,223.20	2,333.49	14,791.31
Newton Corner to West Newton	6,346	13,453	15	1.27	1.24	20.25	17,085.16	16,681.58	272,420.90
West Newton to Rt. 128 Exit	5,706	9,587	28	0.81	1.21	11.46	7,765.26	11,599.95	109,863.99
Rt. 128 Exit to Toll #15	3,015	211	52	0.54	1.43	5.83	113.96	301.77	1,230.30
Toll #15 to Rt. 128 Entrance	3,015	1,417	52	0.54	1.43	5.83	765.13	2,026.18	8,260.58
SUBTOTALS:							49,337.64	79,050.71	662,071.59
TOTALS:							136,828.16	176,374.61	1,966,678.05

Table 4.4
Worcester Commuter Rail Extension Project
Emission Calculations of
Mass. Turnpike Extension - 2001

EASTBOUND - AM

2001
Build Conditions: Worcester Commuter Rail Extension

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Rt. 128 Exit to Toll #15	2,770	1,523	53	0.54	1.47	5.84	822.56	2,239.18	8,895.80
Toll #15 to Rt. 128 Entrance	2,770	111	53	0.54	1.47	5.84	59.82	162.85	646.97
Rt. 128 to West Newton	5,331	10,341	36	0.68	1.23	8.42	7,032.18	12,719.98	87,074.97
West Newton to Newton Corner	6,497	13,384	10	1.64	1.32	26.24	21,950.48	17,667.46	351,207.74
Newton Corner Exit to Entrance	5,448	2,942	32	0.74	1.22	9.75	2,176.85	3,588.86	28,681.46
Newton Corner to Allston-Brighton	7,116	19,497	35	0.69	1.23	8.72	13,452.79	23,981.07	170,012.13
Allston-Brighton Exit to Toll #19	5,303	1,856	48	0.55	1.28	5.82	1,020.90	2,375.91	10,802.95
Toll #19 to A-B Entrance	5,303	1,008	48	0.55	1.28	5.82	554.20	1,289.78	5,864.46
Allston-Brighton to Pru-Copley	7,144	15,716	35	0.69	1.23	8.72	10,843.96	19,330.53	137,042.47
Pru-Copley to Kneeland	4,793	4,409	43	0.60	1.26	6.71	2,645.52	5,555.60	29,585.75
SUBTOTALS:							60,559.27	88,911.21	829,814.69

WESTBOUND - PM

2001
Build Conditions: Worcester Commuter Rail Extension

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Kneeland to Arlington	3,742	1,796	49	0.55	1.32	5.82	988.02	2,371.24	10,455.02
Arlington to Clarendon	4,557	1,230	45	0.58	1.27	6.33	713.67	1,562.69	7,788.83
Clarendon to Copley	4,731	899	43	0.60	1.26	6.71	539.33	1,132.59	6,031.52
Copley to Mass Ave	5,545	2,828	48	0.55	1.28	5.82	1,555.37	3,619.78	16,458.67
Mass Ave to Allston-Brighton	6,082	10,218	45	0.58	1.27	6.33	5,926.72	12,977.48	64,683.01
Allston-Brighton to Toll #19	4,565	1,004	51	0.54	1.39	5.83	542.32	1,395.97	5,855.06
Toll #19 to A-B Entrance	4,565	1,278	51	0.54	1.39	5.83	690.23	1,776.69	7,451.89
Allston-Brighton to Newton Corner	6,331	14,560	43	0.60	1.26	6.71	8,736.12	18,345.85	97,698.94
Newton Corner Exit to Entrance	4,748	1,709	43	0.60	1.26	6.71	1,025.65	2,153.87	11,470.21
Newton Corner to West Newton	5,867	12,437	26	0.85	1.21	12.52	10,571.87	15,049.37	155,717.40
West Newton to Rt. 128 Exit	5,227	8,782	38	0.65	1.24	7.86	5,708.36	10,889.79	69,027.19
Rt. 128 Exit to Toll #15	2,536	178	54	0.54	1.51	5.84	95.85	268.03	1,036.61
Toll #15 to Rt. 128 Entrance	2,536	1,192	54	0.54	1.51	5.84	643.57	1,799.62	6,960.10
SUBTOTALS:							37,737.08	73,342.97	460,634.47
TOTALS:							98,296.34	162,254.18	1,290,449.17

Table 4.4
Worcester Commuter Rail Extension Project
Emission Calculations of
Mass. Turnpike Extension - 2001

EASTBOUND - AM

2001
Build Conditions: Worcester Extension with No-Build Speeds and Emission Factors

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Rt. 128 Exit to Toll #15	2,770	1,523	51	0.54	1.39	5.83	822.56	2,117.32	8,880.57
Toll #15 to Rt. 128 Entrance	2,770	111	51	0.54	1.39	5.83	59.82	153.99	645.86
Rt. 128 to West Newton	5,331	10,341	27	0.83	1.21	11.97	8,583.40	12,513.15	123,787.09
West Newton to Newton Corner	6,497	13,384	5	2.71	1.51	43.74	36,271.84	20,210.51	585,435.47
Newton Corner Exit to Entrance	5,448	2,942	25	0.87	1.21	13.11	2,559.27	3,559.44	38,565.54
Newton Corner to Allston-Brighton	7,116	19,497	28	0.81	1.21	11.46	15,792.41	23,591.13	223,433.37
Allston-Brighton Exit to Toll #19	5,303	1,856	46	0.57	1.27	6.15	1,058.02	2,357.34	11,415.49
Toll #19 to A-B Entrance	5,303	1,008	46	0.57	1.27	6.15	574.35	1,279.70	6,196.98
Allston-Brighton to Pru-Copley	7,144	15,716	28	0.81	1.21	11.46	12,729.86	19,016.21	180,103.98
Pru-Copley to Kneeland	4,793	4,409	38	0.65	1.24	7.86	2,865.98	5,467.41	34,656.33
SUBTOTALS:							81,317.51	90,266.21	1,213,120.67

WESTBOUND - PM

2001
Build Conditions: Worcester Extension with No-Build Speeds and Emission Factors

Turnpike Section	Volume	VMT	Speed	VOC Emission Rate (Gr/mi)	NOx Emission Rate (Gr/mi)	CO Emission Rate (Gr/mi)	Total VOC Emissions(Gr)	Total NOx Emissions(Gr)	Total CO Emissions(Gr)
Kneeland to Arlington	3,742	1,796	47	0.56	1.28	5.98	1,005.98	2,299.39	10,742.45
Arlington to Clarendon	4,557	1,230	40	0.63	1.25	7.37	775.19	1,538.08	9,068.51
Clarendon to Copley	4,731	899	39	0.64	1.24	7.61	575.29	1,114.62	6,840.51
Copley to Mass Ave	5,545	2,828	45	0.58	1.27	6.33	1,640.21	3,591.50	17,900.93
Mass Ave to Allston-Brighton	6,082	10,218	42	0.61	1.25	6.92	6,233.28	12,773.11	70,711.92
Allston-Brighton to Toll #19	4,565	1,004	49	0.55	1.32	5.82	552.36	1,325.67	5,845.02
Toll #19 to A-B Entrance	4,565	1,278	49	0.55	1.32	5.82	703.01	1,687.22	7,439.11
Allston-Brighton to Newton Corner	6,331	14,560	40	0.63	1.25	7.37	9,172.93	18,200.25	107,308.67
Newton Corner Exit to Entrance	4,748	1,709	38	0.65	1.24	7.86	1,111.12	2,119.68	13,436.05
Newton Corner to West Newton	5,867	12,437	15	1.27	1.24	20.25	15,795.62	15,422.49	251,859.22
West Newton to Rt. 128 Exit	5,227	8,782	28	0.81	1.21	11.46	7,113.49	10,626.32	100,642.70
Rt. 128 Exit to Toll #15	2,536	178	52	0.54	1.43	5.83	95.85	253.83	1,034.84
Toll #15 to Rt. 128 Entrance	2,536	1,192	52	0.54	1.43	5.83	643.57	1,704.27	6,948.19
SUBTOTALS:							45,417.90	72,656.43	609,778.11
TOTALS:							126,735.41	162,922.64	1,822,898.78

Table 4.5
Worcester Commuter Rail Extension Study
Emission Reductions Associated with Increased
Massachusetts Turnpike Speeds Due to Reduced Volumes

	1996 Commuter Rail Extension	1996 Commuter Rail Extension with No-Build Emission Rates	NET BENEFIT
VOC IN KG:	123.12	170.82	47.70
NOx IN KG:	198.71	200.51	1.80
CO IN KG:	1,691.84	2,460.46	768.62

	2001 Commuter Rail Extension	2001 Commuter Rail Extension with No-Build Emission Rates	NET BENEFIT
VOC IN KG:	98.30	126.74	28.44
NOx IN KG:	162.25	162.92	0.67
CO IN KG:	1,290.45	1,822.90	532.45

secure overnight storage for the trains. Trains will idle at the facility in the morning approximately 45 minutes prior to departure in order to warm-up and complete Federally-mandated testing procedures. As reported by the MBTA Commuter Rail Directorate, this length of engine warm-up would be utilized even if wayside power were available. Although the land use of the area surrounding the site consists primarily of rail facilities, highways, and some industry, there is a seven-story apartment building, Our Lady of Mount Carmel Apartments, located approximately 260 feet to the north of the site, separated by Shrewsbury Street. This facility is an elderly residence and is therefore a sensitive receptor.

Although four locomotives will layover at the facility, no more than three will be idling concurrently since their start-up schedule is staggered according to their departure times. Based on the proposed schedule of train departures, engines will begin idling on the following schedule:

Train	Departure	Begin Idle
502A	6:00 a.m.	5:15 a.m.
504A	6:50 a.m.	6:05 a.m.
506	7:20 a.m.	6:35 a.m.
506A	7:40 a.m.	6:55 a.m.

As a result of this schedule, the peak hour idling period will begin at 6:30 a.m., during which trains #504A will idle for 20 minutes, #506 for 45 minutes, and #506A for 35 minutes for a total of 100 minutes of idling time.

Idle emission factors for the EMD 16-645E3B engine, used to power the F40PH-2C and F40PH-2 locomotives likely to see service on the Worcester Commuter Rail Extension, are provided by the Locomotive Emission Study, prepared for the California Air Resources Board, by Booz, Allen and Hamilton, Inc. The following emission rates are based on idle conditions operating at 17 horsepower:

Pollutant	Emission Factor
Hydrocarbons(HC)	137 grams per hour
Carbon Monoxide(CO)	445 grams per hour
Oxides of Nitrogen(NO_x)	1,717 grams per hour
Particulates(PM)	32 grams per hour

The two pollutants of primary concern relevant to the layover site are carbon monoxide and oxides of nitrogen. Carbon monoxide is a colorless, odorless gas produced through the incomplete combustion of organic fuels. When combined with the hemoglobin in the blood, it reduces the ability of blood to carry oxygen. In high enough concentration, it can be fatal. Oxides of nitrogen represent a number of compounds produced during combustion. NO_2 is a brownish gas with a pungent odor. It is a pulmonary irritant and short exposures may increase susceptibility to acute respiratory disease.

An analysis of the impacts of these emissions on the sensitive receptor site to the north of the layover site was performed using U.S. EPA's CAL3QHC modeling methodology to predict pollutant concentrations near roadway facilities. This methodology is normally applied to model carbon monoxide levels at receptors near highway intersections. In applying the methodology to the layover facility, the individual locomotives were modeled as queuing links similar to automobiles delayed at an intersection. The analysis was performed using worst-case assumptions regarding the location of the locomotives in relation to the receptor site. That is, the locomotive with the longest idle time during the peak idle hour (#506) was assumed to be located closest to the receptor on the northernmost track, #506A was assumed to be on the adjacent track, and #504A was assumed for the third track. Because the apartment building is seven stories, pollutant levels were modeled at three elevations (2, 10, and 18 meters).

CAL3QHC produces results based on variations in wind direction. Logically, given the orientation of the layover facilities to the receptor site, a southerly wind direction produces the worst-case results in terms of predicted CO levels. Under conditions with a wind angle of 160 to 180 degrees (south-southeast to south), no change in CO levels is predicted as a result of the layover facility, and therefore, this facility will not result in a violation of the CO standard.

The idle emission rate of the EMD 16-645E3B for NO_x is relatively higher than the corresponding rates for the two other pollutants. Given a total idle time between the three locomotives during the peak hour of 100 minutes, this results in emissions of 2,862 grams of NO_x within a one-hour period.

Although not designed for the purpose of estimating NO_x levels, a second analysis was performed using CAL3QHC to analyze NO_x in the vicinity of the layover site. NO_x consists of NO, NO_2, and other oxides of nitrogen. NO_x reacts with volatile organic carbons to form ozone. There is no separate health standard for NO_x. A standard, though, does exist for NO_2, and this is 0.05 ppm averaged over a one year period of time. Further, because of variations in the dispersion and reactivity characteristics between NO_x and CO, the results of the CAL3QHC procedure, which was designed to estimate CO levels, cannot be considered as a definitive estimation of NO_x levels at the receptor site. The results of a CAL3QHC analysis, therefore, can be used only as a preliminary indicator. Assuming both worst-case south-southeasterly and southerly wind conditions and that the locomotive NO_x emissions are composed entirely of NO_2 emissions, this would result in a small increase of NO_2 emissions at the apartment facility during the early morning hours but would not result in a violation of the NO_2 standard.

Given these findings, meteorological data was obtained from the Massachusetts Department of Environmental Protection to determine the likelihood of wind angle conditions which could produce these worst-case conditions. Winds in the Worcester area were observed to be primarily westerly during all four seasons. On an annual basis, winds out of the south and southeast occur with a frequency of less than eight percent, reducing the likelihood of undesirable pollutant levels at the receptor site.

6.0 Worst Case Intersection Analyses

This section calculates and analyzes potential CO emissions associated with the increased traffic resulting from the implementation of the Worcester Commuter Rail Extension. This analysis was conducted using EPA's CAL3QHC program to model air quality impacts at one intersection in each of the following towns: Ashland; Westborough; Southborough; Grafton; and Millbury. The intersection chosen for analysis within each community was assumed to represent "worst case conditions" for each individual community.

The following defines the data sources, assumptions, and results generated for the five intersections for the 1996 AM peak hour conditions for No-Build and Build scenarios.

Edwards and Kelcey, Inc. has provided the following data:

- Sketches of the intersections, which diagramed all possible receptors; and
- CINCH generated traffic data for the intersections for the 1996 AM and PM peak hours for No-Build and Build scenarios.
- In addition to the given receptors, the air quality impacts affecting sidewalks on each of the intersection corners were also modelled.

The key assumptions associated with this analysis are as follows:

- Dimensions of the receptors and links within CAL3QHC were taken from the given measurements provided by Edwards and Kelcey with approximate values determined for all missing measurements.

- AM Peak Hour data was used to determine the 1-hour CO concentrations.

- 1-hour CO concentrations were converted to 8-hour levels by using the EPA's recommended persistence factor of 0.7 (to be used whenever the necessary observation data is not available). This is a conservative estimate because the summary data available for the Worcester area, from the 1992 Air Quality Report for the Commonwealth of Massachusetts, suggests that the persistence factor is between .47 and .58, based on the highest recorded occurrences in 1992. The net result of using the more conservative persistence factor is to predict higher 8-hour CO levels than are likely to occur.

- Background CO levels were based on those used for the Old Colony Commuter Rail study, which were 3 PPM for 1-hour concentrations and 2 PPM for 8-hour levels, as recommended for the Old Colony analysis by the Massachusetts Department of Environmental Protection.

- The Mobile5a emission rate was based on a speed of 20 miles per hour, which is a low estimate of travel speed and therefore a conservative assumption, because lower speeds result in higher emission rates.

- Meteorological conditions were set to the EPA recommended default values, which models the worst case scenario. They consist of:

  - Wind Speed of 1.0 m/s
  - Wind Direction 0-360 degrees by 10 degree increments
  - Mixing Height of 1000 meters
  - Stability of D (Urban)

- Only signalized intersections were selected for this analysis, because they have greater volumes and longer delays than nonsignalized intersections, and would therefore be more adversely affected by an increase in traffic.

Tables 6.1 through 6.5, one for each town, break down the CO levels by receptor. The receptors have been defined by a text description as well as numerical coordinates. The coordinates are in feet and represent the distances, both vertical and horizontal, that the receptors are from the center of the intersection. They show the estimated CO PPM for the 1996 No-Build and Build scenarios as well as the differences between the two, for each receptor. As indicated in the tables, there are no 1-hour or 8-hour violations in either scenario. A violation is defined as any period that exceeds the mandated National Ambient Air Quality Standards (NAAQS), designed to protect human health and property. The 1-hour NAAQS is 35 PPM; the 8-hour NAAQS is 9 PPM. The highest level in this analysis is 9.9 PPM for a 1-hour period and 6.9 for an 8-hour period, well below standards.

The following subsections describe, in detail, results of the intersection analysis conducted for each town.

Ashland

The intersection of Union Street and Main Street was analyzed. The highest predicted 1-hour CO level in the 1996 Build scenario is 7.6 PPM, which is associated with the sidewalks adjacent to the intersection. This compares to a high of 7.2 PPM in the 1996 No-Build scenario. The greatest increase in CO concentration generated by traffic associated with the Worcester Commuter Rail is 0.6 PPM, which represents an increase of 8.6%. See Table 6.1.

The traffic level of service associated with this intersection improves in the 1996 Build scenario. This is based on the optimization process within the CINCH program, which adjusts the phase timings. This intersection has a LOS of E with a delay of 47.58 seconds in the 1996 No-Build. In the Build condition, there is a LOS of D with a delay of 32.15 seconds.

Southborough

The intersection of Cordaville Street and Main Street was analyzed. The highest predicted 1-hour CO level in the 1996 Build scenario is 6.7 PPM, which is associated with the sidewalks adjacent to the intersection. This compares to a high of 6.8 PPM in the 1996 No-Build scenario. The greatest increase in CO concentration generated by traffic associated with the Worcester Commuter Rail is 0.4 PPM, which represents an increase of 6.6%. See Table 6.2.

The traffic level of service associated with this intersection is one level lower in the 1996 Build scenario. This intersection has a LOS of D with a delay of 35.26 seconds in the 1996 No-Build. In the Build condition, there is a LOS of E with a delay of 50.59 seconds.

Westborough

The intersection of Otis Street and Route 9 was analyzed. The highest predicted 1-hour CO level in the 1996 Build scenario is 9.9 PPM, which is associated with the sidewalks adjacent to the intersection. This compares to a high of 9.9 PPM in the 1996 No-Build scenario. The greatest increase in CO concentration generated by traffic associated with the Worcester Commuter Rail is 0.2 PPM, which represents an increase of 3.0%. See Table 6.3.

The traffic level of service associated with this intersection is unchanged as a result of the 1996 Build scenario. This is based on the optimization process within the CINCH program, which adjusts the phase timings. This intersection has a LOS of C with a delay of 15.92 seconds in the 1996 No-Build. In the 1996 Build condition, there is a LOS of C with a delay of 16.37 seconds.

Grafton

The intersection of Shrewsbury, Waterville and East was analyzed. This intersection is not currently signalized but will be in the future. The analysis has been completed based on the proposed signalized intersection. The highest predicted 1-hour CO level in the 1996 Build scenario is 7.9 PPM, which is associated with the sidewalks adjacent to the intersection. This compares to a high of 7.9 PPM in the 1996 No-Build scenario. The greatest increase in CO concentrations generated by traffic associated with the Worcester Commuter Rail is 0.1 PPM, which represents increases of 1.7%, 2.0%, and 2.4%. See Table 6.4.

The traffic level of service associated with this intersection is unchanged as a result of the 1996 Build scenario. This is based on the optimization process within the CINCH program, which adjusts the phase timings. This intersection has a LOS of B with a delay of 12.46 seconds in the 1996 No-Build. In the Build condition, there is a LOS of B with a delay of 12.43 seconds.

Millbury

The intersection of Route 122 and Exit 11 of Mass. Pike was analyzed. The highest predicted 1-hour CO level in the 1996 Build scenario is 7.3 PPM, which is associated with the sidewalks adjacent to the intersection. This compares to a high of 6.0 PPM in the 1996 No-Build scenario. The greatest increase in CO concentrations generated by traffic associated with the Worcester Commuter Rail is 1.3 PPM, which represents an increase of 21.7%. See Table 6.5.

The traffic level of service associated with this intersection is unchanged as a result of the 1996 Build scenario. This is based on the optimization process within the CINCH program, which adjusts the phase timings. This intersection has a LOS of B with a delay of 5.4 seconds in the 1996 No-Build. In the Build condition, there is a LOS of B with a delay of 10.47 seconds.

Table 6.1
Worcester Commuter Rail Extension Study
Intersection Analysis Results - AM Peak 1996
Ashland: Intersection of Union St. and Main St.
1-Hour and 8-Hour CO Levels in PPM

Receptor Number	Receptor Description	Vertical Set-back	Horizontal Set-back	1-Hour Worst Case Levels			8-Hour Worst Case Levels		
				No-Build	Build	Difference	No-Build	Build	Difference
1	Two Family Home	-43	-53	5.3	5.5	0.2	3.7	3.8	0.1
2	Single Family Home	-43	-153	4.8	5.2	0.4	3.4	3.6	0.3
3	Real Estate Office/Home	48	-48	5.8	6.1	0.3	4.1	4.3	0.2
4	Business Office	53	53	5.1	5.5	0.4	3.6	3.8	0.3
5	Funeral Home	-38	143	4.7	5.0	0.3	3.3	3.5	0.2
6	Northwest Corner Sidewalk	-24	24	6.4	6.9	0.5	4.5	4.8	0.4
7	Northeast Corner Sidewalk	24	24	7.0	7.6	0.6	4.9	5.3	0.4
8	Southwest Corner Sidewalk	-24	-24	6.5	6.8	0.3	4.6	4.8	0.2
9	Southeast Corner Sidewalk	24	-24	7.2	7.6	0.4	5.0	5.3	0.3
Worst Condition Value:				7.2	7.6	0.6	5.0	5.3	0.4

* 1-Hour standard of 35 PPM is not broken in the Build or No-Build scenarios.
* 8-Hour standard of 9 PPM is not broken in the Build or No-Build scenarios.
* Set-Backs are based on distance in feet from the center of the intersection.

Table 6.2
Worcester Commuter Rail Extension Study
Intersection Analysis Results - AM Peak 1996
Southborough: Intersection of Cordaville St. and Main St.
1-Hour and 8-Hour CO Levels in PPM

Receptor Number	Receptor Description	Vertical Set-back	Horizontal Set-back	1-Hour Worst Case Levels No-Build	Build	Difference	8-Hour Worst Case Levels No-Build	Build	Difference
1	Single Family Home	-45	45	4.8	5.0	0.2	3.4	3.5	0.1
2	Single Family Home	-125	45	4.4	4.5	0.1	3.1	3.2	0.1
3	Single Family Home	-50	125	4.6	4.6	0.0	3.2	3.2	0.0
4	Library	115	85	4.3	4.3	0.0	3.0	3.0	0.0
5	American Legion	-75	-235	4.0	4.0	0.0	2.8	2.8	0.0
6	Police/Fire Station	115	-315	3.6	3.7	0.1	2.5	2.6	0.1
7	Southeast Corner Sidewalk	-15	-15	6.8	6.7	-0.1	4.8	4.7	-0.1
8	Southwest Corner Sidewalk	-15	15	6.3	6.4	0.1	4.4	4.5	0.1
9	Northwest Corner Sidewalk	15	15	6.0	6.4	0.4	4.2	4.5	0.3
10	Northeast Corner Sidewalk	15	-15	6.2	6.5	0.3	4.3	4.6	0.2
Worst Condition Value:				6.8	6.7	0.4	4.8	4.7	0.3

* 1-Hour standard of 35 PPM is not broken in the Build or No-Build scenarios.
* 8-Hour standard of 9 PPM is not broken in the Build or No-Build scenarios.
* Set-Backs are based on distance in feet from the center of the intersection.

Table 6.3
Worcester Commuter Rail Extension Study
Intersection Analysis Results - AM Peak 1996
Westborough: Intersection of Route 9 and Otis St.
1-Hour and 8-Hour CO Levels in PPM

Receptor Number	Receptor Description	Vertical Set-back	Horizontal Set-back	1-Hour Worst Case Levels No-Build	1-Hour Worst Case Levels Build	1-Hour Worst Case Levels Difference	8-Hour Worst Case Levels No-Build	8-Hour Worst Case Levels Build	8-Hour Worst Case Levels Difference
1	Apartment Bldg	124	148	5.4	5.4	0.0	3.8	3.8	0.0
2	Parking Lot	-54	-78	6.7	6.9	0.2	4.7	4.8	0.1
3	Shopping Plaza	-224	-148	5.3	5.2	-0.1	3.7	3.6	-0.1
4	New Car Lot	54	-78	7.7	7.8	0.1	5.4	5.5	0.1
5	Car Dealership	504	-168	4.3	4.3	0.0	3.0	3.0	0.0
6	Vacant Lot	-74	98	5.8	5.8	0.0	4.1	4.1	0.0
7	Southwest Corner Sidewalk	-24	-48	9.3	9.3	0.0	6.5	6.5	0.0
8	Northwest Corner Sidewalk	-24	48	8.5	8.5	0.0	5.9	5.9	0.0
9	Northeast Corner Sidewalk	24	48	8.3	8.4	0.1	5.8	5.9	0.1
10	Southeast Corner Sidewalk	24	-48	9.9	9.9	0.0	6.9	6.9	0.0
Worst Condition Value:				9.9	9.9	0.2	6.9	6.9	0.1

* 1-Hour standard of 35 PPM is not broken in the Build or No-Build scenarios.
* 8-Hour standard of 9 PPM is not broken in the Build or No-Build scenarios.
* Set-Backs are based on distance in feet from the center of the intersection.

Table 6.4
Worcester Commuter Rail Extension Study
Intersection Analysis Results - AM Peak 1996
Grafton: Intersection of Route 140, Waterville St. and East St.
1-Hour and 8-Hour CO Levels in PPM

Receptor Number	Receptor Description	Vertical Set-back	Horizontal Set-back	1-Hour Worst Case Levels No-Build	Build	Difference	8-Hour Worst Case Levels No-Build	Build	Difference
1	Single Family Home	-22	52	4.1	4.2	0.1	2.9	2.9	0.1
2	Service Garage	72	-30	5.0	5.0	0.0	3.5	3.5	0.0
3	Store/Apartment Bldg	-30	-30	5.1	5.1	0.0	3.6	3.6	0.0
4	Single Family Home	38	-102	4.1	4.1	0.0	2.9	2.9	0.0
5	Single Family Home	-128	-72	4.0	4.0	0.0	2.8	2.8	0.0
6	Single Family Home	-23	-126	3.7	3.7	0.0	2.6	2.6	0.0
7	Southwest Corner Sidewalk	-22	21	5.0	5.1	0.1	3.5	3.6	0.1
8	Southeast Corner Sidewalk	-22	-20	5.9	6.0	0.1	4.1	4.2	0.1
9	Northeast Corner Sidewalk	22	-20	7.9	7.9	0.0	5.5	5.5	0.0
Worst Condition Value:				7.9	7.9	0.1	5.5	5.5	0.1

* 1-Hour standard of 35 PPM is not broken in the Build or No-Build scenarios.
* 8-Hour standard of 9 PPM is not broken in the Build or No-Build scenarios.
* Set-Backs are based on distance in feet from the center of the intersection.

Table 6.5
Worcester Commuter Rail Extension Study
Intersection Analysis Results - AM Peak 1996
Millbury: Intersection of Route 122 and Mass. Pike Exit 11
1-Hour and 8-Hour CO Levels in PPM

Receptor Number	Receptor Description	Vertical Set-back	Horizontal Set-back	1-Hour Worst Case Levels No-Build	1-Hour Worst Case Levels Build	1-Hour Worst Case Levels Difference	8-Hour Worst Case Levels No-Build	8-Hour Worst Case Levels Build	8-Hour Worst Case Levels Difference
1	Single Family Home	126	-28	3.6	4.0	0.4	2.5	2.8	0.3
2	Single Family Home	96	85	3.8	4.0	0.2	2.7	2.8	0.1
3	Single Family Home	96	160	3.6	3.9	0.3	2.5	2.7	0.2
4	Liberty Heights Bar	56	-239	4.0	4.2	0.2	2.8	2.9	0.1
5	Northeast Corner Sidewalk	26	-14	6.0	7.3	1.3	4.2	5.1	0.9
6	Northwest Corner Sidewalk	26	50	5.2	5.6	0.4	3.6	3.9	0.3
Worst Condition Value:				6.0	7.3	1.3	4.2	5.1	0.9

* 1-Hour standard of 35 PPM is not broken in the Build or No-Build scenarios.
* 8-Hour standard of 9 PPM is not broken in the Build or No-Build scenarios.
* Set-Backs are based on distance in feet from the center of the intersection.

SECTION 7.0

CITIZENS ADVISORY COMMITTEE - MINUTES OF MEETINGS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

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Mr. Michael O'Bryan
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(508) 345-7843 (W)

Mr. James R. Waterman
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

A video tape of the meeting can be made available by contacting Judith McCabe (508) 366-4094.

CITIZENS ADVISORY COMMITTEE MEETING

February 2, 1993, 7:30 pm

Forbes Community Center
9 East Main Street
Westborough, Massachusetts

MINUTES

The meeting was called to order by Carol Dwyer, who served as interim Chair. Carol welcomed the members of the CAC, outlined the format of the meeting, and explained the contents of the Workbooks which were distributed.

Each person introduced themselves, and explained briefly their interests and involvement in the project.

Questions and Comments by Members of the CAC:

The ridership figures have been requested for several months.

The project schedule is unrealistic.

The MBTA needs to have a clear project definition before the environmental impacts can be evaluated.

Why are there no members on the CAC representing Framingham?

What is the nature of the MBTA assessment and possibility for change?

What is the status of the regional station?

The MBTA said that the current budget for the project is $120 million, including $34 million for equipment. They stated that there will be reverse commute, but the level of service has not yet been determined.

Attending:

Members of the Citizens Advisory Committee:
Matt Amorello, Patricia Austin, Ed Bates, Pat Murphy Capone, Steve Doret, Jay Duncan, Bill Engstrom, Bob Gentile, Maureen Halloran-Castillo, Margaret A. Lavallee, Dex Malone, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Mary Snyder, Peter Stanton, George Tetler, Wayne Thies, and Randy Waterman.

MBTA Staff:
Rocco Mancini, Assistant Director of Construction and Design; Jim Eng, Project Manager; Sylvia Hill, Community Liason.

Edwards and Kelcey Staff:
Bob Joseph, Project Manager,
Carol Dwyer, CAC Liason.

Members of the CAC who were absent :
Kathleen Bartolini, Lydia Boyar, James Falconi, Larry Gomes and Brennan Wall.

prepared by:
Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

February 9, 1993, 7:30 pm

Forbes Community Center
9 East Main Street
Westborough, Massachusetts

MINUTES

The meeting was called to order and members of the CAC, and MBTA and Edwards and Kelcey staffs introduced themselves.

Jollene Dubner of the Massachusetts Environmental Protection Act Unit of the Office of Environmental Affairs explained that the role of the CAC under MEPA's process for a "Major and Complicated Project" is to inform the MBTA about environmental impacts, assist in preparing the environmental documents, and comment to the Secretary of Environmental Affairs about the documents.

Ms. Dubner was asked if the Central Massachusetts Planning Commission, Town of Framingham, and the Worcester Transit Authority should be represented on the CAC. She responded that the meetings were open to the public, and that anyone could attend. Towns with new stations were the focus of CAC membership selection.

Ms. Dubner will not attend the meetings of the CAC, but she is open to any questions from the committee, or it might be decided that contacts should be made through the Chairman. "You have the ear of the Secretary (of Environmental Affairs)", Jollene commented.

The following materials were distributed to the CAC for inclusion in their Workbooks: a revised List of Members; Minutes of the Meeting of February 2, 1993; Comments on the Environmental Notification Form submitted to Secretary Tierney; the Draft Environmental Impact Report Outline, Central Transportation Planning Staff Ridership Projections per Memo of Yong B. Chang , December 16, 1992; Preliminary Draft Regional Station Analysis, Project Progress chart (February 8, 1993); and DEIR Schedule (February 8, 1993). In addition, each member was given copies of the MBTA's "Fiscal Year 1994 Budget", and "Building for Tomorrow: The MBTA's Capital Program FY 93 - FY 97".

Mike O'Bryan suggested that an Interim Chair be elected. David Robbins was nominated and elected Interim Chair. Mr. O'Bryan then suggested that the Interim Chair be made permanent, and a vice chair be elected. A vote was taken 10 for and 8 against to make the Interim Chair permanent. Kathy Bartolini was elected Vice Chair.

It was agreed that a letter should be written to ask John J. Haley, Jr., General Manager of the MBTA, for a revised project schedule.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

February 9, 1993, 7:30 pm

Forbes Community Center
9 East Main Street
Westborough, Massachusetts

MINUTES

The CAC will determine those financial issues it wishes to have included in the DEIR. It was suggested that the MBTA prepare a draft financial scope to assist the CAC.

The next meeting of the Citizens Advisory Committee will be at 7:00 pm at the Senior Center, Main Street in Westborough.

Attending:

Members of the Citizens Advisory Committee:
Matt Amorello, Patricia Austin, Kathy Bartolini, Ed Bates, Pat Murphy Capone, Steve Doret, Jay Duncan, Bill Engstrom, Bob Gentile, Margaret A. Lavallee, Dex Malone, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Mary Snyder, Peter Stanton, George Tetler, Wayne Thies and Randy Waterman.

MBTA Staff:
Rocco Mancini, Assistant Director of Construction and Design; Jane Chmielinski, Manager of Environmental Affairs; Sylvia Hill, Community Liaison.

Edwards and Kelcey Staff:
Bob Joseph, Project Manager, Carol Dwyer, CAC Liaison

Also Attending:
Marsha Platt of North Grafton, State Rep for the 9th District, Worcester.

Members of the CAC who were absent:
Lydia Bogar, James Falconi, Larry Gomes, Maureen Halloran-Castillo, and Brennan Wall.

prepared by:
Carol Dwyer

A video tape of the meeting can be made available by contacting Judith McCabe (508) 366-4094.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

March 2, 1993, 7:00 pm

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

The meeting was called to order at 7:20 pm

Legal Requirements for the CAC: Under the open meeting law, meeting notices should be posted in two communities, such as Westborough and Grafton. To meet the requirements of the public record law, minutes should be taken and formally approved. A video recording is not sufficient. Regarding conflict of interest rules, Lydia Bogar, who is on the staff of the State Ethics Commission, will provide an opinion in writing at or before the next meeting to guide CAC members.

Minutes: The minutes of the first two meetings were approved.

Revised Schedule: The MBTA reported that a completed Draft EIR should be available to the CAC at the end of April. Ridership projections from CTPS are due this Friday, and will be available for distribution at the next meeting. A schedule for the next chapters of the Draft EIR was requested.

Financial Assessment: The MBTA distributed a summary of the present assessment procedure. The pros and cons of including a financial assessment in the EIR were discussed. The following comments were made favoring inclusion of a financial assessment:

Communities have requested a model showing what the assessment would be for each town if new and existing communities were included in the assessment procedure.

If the financial impacts are not forthcoming, townspeople may reject the project.

MBTA staff members, General Manager John Haley, and the Secretary of Environmental Affairs have previously encouraged inclusion of a financial assessment.

Since the goal of the project is to foster economic development, a financial analysis is relevant.

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

Those not favoring inclusion of a financial assessment in the EIR commented as follows:

There is no correlation between finances and environmental impacts, and so a financial assessment is not appropriate in the EIR.

Financial questions cannot be resolved by the CAC since there are many possible ways of funding the service.

The people who should concern themselves with this issue are the town selectmen, not the CAC.

A subcommittee was formed that will meet in Southborough on March 9th to draft a financial scope. The subcommittee members are Mat Amorello, Ed Bates, Katherine Bartolini, Steve Doret and Margaret Lavallee.

Traffic and Ridership Analysis: CAC members questioned what would happen if the demand for parking exceeded available spaces, as predicted in Southborough. Insufficient parking could reduce commuter rail ridership. Commuters might park improperly or illegally. Would the MBTA make a commitment to build a garage or otherwise expand parking if there were insufficient parking to meet demand, or would the towns be responsible for addressing the situation once the project is built? Faster train service from Framingham will increase ridership from that station and people will come from a greater distance to the Framingham station than previously. It was suggested that commuters tend to travel to the east in order to shorten the trip distance and move into a less expensive fare zone, and this would have a "domino effect" at the commuter rail stations. The MBTA offered to provide information about Framingham ridership taking into account express service.

It was pointed out that the methodology for developing ridership figures is important and using the wrong model could have invalid results. The CAC requested that the methodology be clarified and the margins of error or estimated variability of the ridership figures explained.

It was suggested that the study area be extended to the west and include communities as far west as Sturbridge. A frequency distribution schedule of trains was requested.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

March 2, 1993, 7:00 pm

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

Draft EIR Review Procedure: Each CAC member will send their questions and comments on the first six chapters of the Draft EIR to Edwards and Kelcey, Inc. The questions and comments will be collated and the CAC will then review each item. If this system is effective, it will be repeated for the next sections of the Draft EIR.

Next Meeting: The next meeting of the CAC will be held on Tuesday night, March 16th, at the Grafton Municipal Center.

The meeting was adjourned at 9:55 pm.

Attending:

Members of the Citizens Advisory Committee:

Matt Amorello, Patricia Austin, Kathy Bartolini, Ed Bates, Lydia Bogar, Steve Doret, Jay Duncan, Bob Gentile, Maureen Halloran-Castillo, Margaret A. Lavallee, Dex Malone, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Mary Snyder, Peter Stanton, George Tetler, Wayne Thies and Randy Waterman.

MBTA Staff:

Jane Chmielinski, Jim Eng, and Sylvia Hill.

Edwards and Kelcey Staff:

Bob Joseph and Carol Dwyer

Members of the CAC who were absent:

Patricia Murphy Capone, James Falconi, Larry Gomes, and Brennan Wall.

Prepared by: Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Grafton Municipal Center

MINUTES

The meeting was called to order at 7:20 pm.

It was questioned whether a quorum was present. Jollene Dubner will be asked to determine the number of members that constitutes a quorum. Acceptance of the Minutes of March 2 was deferred to the next meeting of the CAC.

Ridership Information

The ridership information which was expected from Central Transportation Planning Staff has not been provided to the MBTA, and may not be available for two months. Chairman Robbins will write a letter for the Committee to Secretary James J. Kerasiotes with copies to Governor Weld, Arnold Soolman, Director of CTPS, and Representative Kollios urging that this project be given priority by CTPS.

Financial Assessment

The subcommittee to prepare a financial assessment scope has met, and will submit a draft to the CAC for review at its next meeting.

Review of Handouts

MBTA and Edwards and Kelcey staff reviewed handouts provided to the Committee: A diagram of the MBTA Commuter Rail System; A map of the MBTA Service Area - 78 Member Cities and Towns; MBTA District Estimated Assessments for 1991; MBTA Service Outside the District; 1980 and 1990 US Census Journey-to-Work Data; Schedule of DEIR Sections and Anticipated Submission Dates; and Section 18.0 of the DEIR, "Circulation List".

Schedule for the Draft EIR

The schedule now calls for distribution of the complete Draft EIR for CAC review in mid May, with disclaimers for wetlands mapping, track survey and expanded surveys on the station sites themselves, which can not be completed with snow cover. A decision on the Grafton Station site with DCPO is due this week. The delay in receipt of ridership information will slow preparation of the draft documents.

MINUTES

Train Schedule/Reverse Commute

A working or preliminary schedule of train service to and from Worcester will be provided to the CAC. It was pointed out by Mike O'Bryan that the MBTA does not have enough locomotives to provide a full reverse commute schedule. Bob Gentile suggested that the Worcester schedule be similar to the Fitchburg schedule which provides nine rather than 16 trains a day.

Framingham Station

In response to previous questions about the Framingham station, the MBTA said that the Framingham station is under design to provide 390 additional parking spaces, but that the project is not funded at this time. Framingham now boards 624 commuters a day.

Review of Chapters 1 - 6 of the Draft EIR

The CAC reviewed and commented on the Draft EIR, Chapters 1 - 6. Copies of the written comments submitted to date by nine members will be distributed to all CAC members. Others who wish to submit comments should do so by Tuesday, March 23. The comments will be collated and reviewed for appropriate response by Edwards and Kelcey, Inc.

The next meeting of the CAC will be March 30, if there is ridership information to review at that time, or on April 6. The CAC will be informed of the time and place of the next meeting.
The meeting was adjourned at 10:00.

Attending:

Members of the Citizens Advisory Committee:
Matt Amorello (9:30), Bob Gentile, Dex Malone, Mike O'Bryan, David C. Robbins, Edward J. Ropiak, Mary Snyder, George Tetler, Wayne Thies and Brennan Wall.

MBTA Staff:
Jim Eng

Edwards and Kelcey Staff
Jim Herlihy, Bob Joseph, MaryAnn Magner and Carol Dwyer

MINUTES

Other Residents:
Jeffrey A. Dore, Chairman of the Millbury MBTA Committee; Charles Gaffney, Southborough; David S. Goldman, Hopkinton; John H. Hall, Grafton; and David Rice, Senator Amorello's office.

Members of the CAC who were absent:
Patricia Austin, Kathy Bartolini, Ed Bates, Lydia Bogar, Patricia Murphy Capone, Steve Doret, Jay Duncan, James Falconi, Larry Gomes, Maureen Halloran-Castillo, Margaret A. Lavallee, Judy McCabe, Fred Moseley, John A. Reil, Peter Stanton, and Randy Waterman.

Prepared by: Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

The meeting was called to order at 7:15 P.M.

Minutes: The minutes of the meetings of March 2 and March 16 were approved.

Status of Ridership Figures: David Robbins, Chair, noted the response of Secretary Kerasiotes to David's letter saying the CTPS ridership figures would be available on April 16.

Next Meeting: The next meeting of the Citizens Advisory Committee will take place on Tuesday April 20, 1993 at the Westborough Senior Center at 7:00 pm.

Review of Comments on the Draft Chapters 1 - 6: Nine CAC members submitted written comments on the draft. With a few exceptions responses to these comments will be provided through explanations or additions to the final Draft EIR. Ten of the comments related to ridership have been forwarded to CTPS.

E&K will send all the comments to the CAC members marked to indicate the manner in which responses will be made.

Financial Analysis Subcommittee Report: Ed Bates and Kathy Bartolini of the Financial Assessment Subcommittee reviewed the Subcommittee's recommendations in a memo distributed to the CAC. The subcommittee concluded that there were legitimate rationales for including a financial analysis in the environmental review process, and that there was merit in providing several alternative figures to the communities under different assessment scenarios.

It was recognized that an examination of state funding sources for MBTA service was outside of the scope of the EIR, but the subcommittee hoped that the CAC might request that a joint legislative committee of the State Legislature appoint an advisory committee to make recommendations on this issue, and that this initiative would be independent of the CAC's review of the Worcester Commuter Rail Project, and in no way impede or slow that process.

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EIR Financial Analysis: It was moved that recommendation #1 in the subcommittee's memo be adopted by the CAC with a minor change to read as follows:

> *"That the MBTA and its consultant, as an element of the current DEIR study estimate the assessment to the communities. Following are alternatives that should be considered:*
>
> - *No change to existing regulations*
> - *Application of the existing assessment regulations to the communities with new stations, plus assessment to other communities whose residents will use the service*
> - *Include Old Colony and Newburyport service in the analysis*
> - *Other alternatives"*

A friendly amendment was requested and accepted to include the vote in the letter to the Secretary of Environmental Affairs.

CAC members commented opposing the motion as follows:
There are 52 cities and towns now who have MBTA service and are not assessed. It's a political issue, and raising these questions is more likely to create controversy than quell it.

CAC members commented supporting the motion as follows:
The General Manager of the MBTA and the Governor have publicly expressed a desire to change the law now governing assessments. Therefore many believe that the present assessment procedure will be changed. Westborough has been quoted a future hypothetical assessment figure. The MBTA's provision of a range of possible assessment figures might clarify the issue.

The vote was 13 for and 5 against the motion.

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It was requested that a minority report be sent with the vote. It was agreed that those who wished could write letters to the Secretary as individuals.

Recommendation to the State Legislature:

It was moved to endorse point # 2 of the Subcommittee's memo. The recommendation was approved by a vote of 12 for and 6 against, as proposed by the subcommittee:

> *"That the Massachusetts Legislature fund and direct an analysis of alternative methods of equitably financing public transit services. The study should include but not be limited to:*
>
> - *Expansion of the MBTA district to all communities with service*
> - *Expansion of the MBTA district to all communities with residents using services.*
> - *Community assessments for services provided and services used*
> - *Commuter rail services provided by a new authority*
> - *New funding sources*
> - *Fare structure alternatives*
>
> *The study should be monitored by an advisory committee of local appointees and appropriate groups.*
>
> *Finally, it is recommended that this position by the Worcester Rail Extension CAC be distributed to the Legislature, the Secretary of EOTC, the other agencies of the Boston Metropolitan Planning Organization in an effort to encourage support."*

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

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MINUTES

Ed Bates and Kathy Bartolini will prepare a draft letter to be sent out under David Robbin's signature. Copies of the letters to the Secretary and the State Legislature will be sent to committee members.

The meeting was adjourned at 9:20.

Members Attending:

Senator Amorello, Patricia Austin, Kathy Bartolini, Ed Bates, Lydia Bogar, Pat Murphy Capone, Steve Doret, Jay Duncan, Bob Gentile, Larry Gomes, Margaret A. Lavallee, Judy McCabe, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Mary Snyder, Peter Stanton, George Tetler and Randy Waterman.

MBTA Staff:

Jane Chmielinski and Jim Eng.

Edwards and Kelcey Staff:

Carol Dwyer, Jim Herlihy and Bob Joseph.

Others Attending:

Steve Bishop, Town Planner, Millbury; David S. Goldman, Hopkinton; Penny P. Kelley, Westborough; Barbara A. Smith, The Westborough Chronotype; Carole Williams, Westborough News.

Members who were absent:

James Falconi, Maureen Halloran-Castillo, Dex Malone, Fred Moseley and Wayne Theis.

A video tape of the meeting can be made available by contacting Judith McCabe (508) 366-4094.

prepared by:
Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, April 27, 1993

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

The meeting was called to order at 7:20 pm

The Minutes of the meeting of April 6 were accepted.

CTPS Ridership and Parking Demand Estimates

Ridership and parking demand were recently revised to reflect 1990 Census data by the Central Transportation Planning Staff.

Bob Joseph provided an overview of CTPS and their function. To a question about the percentage of error in CTPS forecasting, it was stated that the modeling used four or five assumptions and that the margin of error could be 10% to 25%.

Citizens Advisory Committee members had comments and questions about the ridership figures provided in the memorandum of April 14, 1993 from Yong B. Chang of CTPS as follows:

The process for determining how residents from one town were assigned to particular stations was questioned. Were local driving patterns considered? Several CAC members commented from their experience. One felt that the assumption that all of Marlborough riders will go to Southborough is incorrect, and that many will travel to the Ashland Station via Oak Hill Road. Another commented that people will travel toward the cheaper zone, and that anyone east of downtown Westborough would travel four miles to Southborough rather than two miles through Westborough Center to the Otis Street site. It was questioned why no Westborough residents were indicated as prospective commuters from the Grafton Station. It was inquired if census tract information had been used.

MINUTES

The numbers of riders using the Millbury station were thought by some to be low. It was noted that more people take the express bus than the 155 riders calculated to use the Millbury Station, and a question was raised about how the numbers could have changed so radically from the figures originally proposed.

It was asked how ridership from the Worcester communities was assigned, whether or not CTPS took new capital improvements in roadways into account, and whether the future capacity of the Massachusetts Turnpike would affect commuter rail ridership.

One CAC member questioned the change from 8% "kiss and ride" passengers in the unconstrained models to 20% in the contrained scenarios, and asked for more documentation of these figures. Another asked about the effect of the 20% "kiss and ride" travelers on air quality calculations.

Larry Gomes distributed a report he had prepared to the CAC members. He noted that in the original feasibility study there were more parking spaces to be provided east of Route 495 than to the west. In the current EIR, there are 800 parking spaces east of Route 495 and 1,700 parking spaces west of Route 495, while the ridership figures indicate that more spaces are needed at the eastern stations, and fewer to the west. He asked why four stations are proposed west of Route 495 and only two east of Route 495.

The MBTA was asked at what point a rail station would not be considered economically feasible. It was questioned whether all the stations were needed. One member felt that the station locations should be located to meet demand, rather one to each town.

MINUTES

A member questioned if the CAC should continue in this review if the MBTA is going to eliminate one or more stations. One commenter felt that eliminating a station would change the ridership distribution numbers.

Kathy Bartolini, a member of the Program for Mass Transportation Committee, noted that there has been a shift in priorities from transportation projects which bolster economic development toward projects which respond to existing traffic problems and air quality issues. She said that emphasizing the economic development benefits of this project might improve its PMT rating, and asked if the economic development potential at each station site was being analyzed.

Scope of CAC Review

The scope of CAC review was discussed. One member commented that the CAC should not revisit the feasibility study, and that the purpose of the CAC is to review the environmental impacts of the project as it is presented. It was pointed out that the "no-build" option is a way to evaluate an extension of existing transit operations. Another pointed out that the question of whether or not a particular station is built is within the scope of review as written in the Certificate of the Secretary of Environmental Affairs. Several members believe that the feasibility of project funding is not within the scope of CAC review.

It was agreed that the questions of the CAC about the basis of the ridership figures would be collated, and sent to CTPS, and that a CTPS staff member would be asked to come to the next meeting of the CAC to respond to these questions.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

Westborough Senior Center
9 East Main Street
Westborough, Massachusetts

MINUTES

Schedule of Draft EIR

Four additional chapters have been submitted to the MBTA for review. Traffic counts will be completed in about three weeks.

Jim Eng said it was hoped that the final draft would be completed in June, and that the project would be completed in 1994.

Site Visits

The CAC agreed that a visit to the proposed station sites would be helpful. Arrangements will be investigated.

The meeting was adjourned at 9:45 pm.

The next meeting of the committee will be on May 11, 1993 at the
FORBES COMMUNITY CENTER, 9 East Main Street, Westborough at 7:30 pm NOT THE WESTBOROUGH SENIOR CENTER.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, April 27, 1993

Westborough Senior Center
9 East Main Street
Westborough, Massachusetts

MINUTES

Attending:

Members of the Citizens Advisory Committee:
Senator Mat Amorello, Patricia Austin, Kathy Bartolini, Lydia Bogar, Steve Doret, Bob Gentile, Larry Gomes, Margaret A. Lavallee, Dex Malone, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Mary Snyder, Peter Stanton, and George Tetler.

MBTA Staff:
Jane Chmielinski, and Jim Eng.

Edwards and Kelcey Staff:
Frank Astone, Carol Dwyer and Bob Joseph.

Also Attending:
Steve Bishop, Millbury Town Planner; Penny P. Kelley, Westborough; David Rize, Office of Senator Amorello; and Carole Williams, Westborough News.

Members of the CAC who were absent:
Ed Bates, Pat Murphy Capone, Maureen Halloran Castillo, Jay Duncan, Jim Falconi, Wayne Theis, Randy Waterman.

prepared by:
Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, May 11, 1993

Forbes Community Center
9 East Main Street
Westborough, Massachusetts

MINUTES

The meeting was called to order at 7:45.

The minutes of the meeting of April 27th were approved.

Discussion of Ridership Figures

Bob Joseph introduced Yong B. Chang, Deputy Director of the Central Transportation Planning Staff. Yong Chang reviewed the parking demand estimation procedures for the Worcester Commuter Rail Extension Project. He compared the older projections, which used 1980 census data, with the updated projections which used 1990 census data. The latest census data indicates more growth in work trips of commuters from towns on the east end of the line than from the western towns. As a result, ridership estimates are higher than originally proposed for the eastern stations, and lower for stations to the west. Mr. Chang responded to the comments and questions of the Citizens Advisory Committee members.

Mr. Chang explained that the 20% "kiss and ride" figures in the constrained model were based on surveys made at existing stations. Some stations where the residential densities are high have as high as 40% to 50% "kiss and ride" commuters, and the average for all stations is about 30%, so 20% is a conservative figure.

To make individual station allocations the towns were divided into sections. Allocations were based on travel time and cost.

The margin of error in CTPS ridership estimates is 10% to 25%, based on observation, with the larger margin of error being in stations with low ridership.

A member of the CAC pointed out that parking lots which are not large enough to meet demand do constrain parking because commuters learn when lots will be full, and do not repeatedly drive to stations which are already at capacity. Illegal parking is controlled through policing.

MINUTES

Mr. Chang noted that the 1990 census numbers for Central Business District commuters will be available in June, but he assumes that using a figure which represents 66% of all Boston commuters will be an accurate reflection of the Central Business District figure since the 1990 numbers of employers in the CBD have remained at 66% of the total Boston figure.

Mr. Chang was asked the overall percentage of Boston commuters who would take the train if parking were available, and he replied as many as 60% and 65% of all commuters might travel by rail if parking were available.

There would be no difference in projected ridership figures whether the regional station or local stations were built first as the same assumptions are used in either case. If the regional station were built without local stations in Westborough and Southborough, the ridership projected for the regional station would equal the sum projected for all three stations.

A CAC member asked how many of the projected rail commuters were now using express buses or vanpools rather than single occupancy vehicles. Mr. Chang replied that it is expected that many people now traveling by bus would switch to the train.

Rocco Mancini commented that the limiting factor on auto traffic to Boston is the cost of parking in Boston. In response to questions about parking structures, Mr. Mancini said that the MBTA would not force a community into having a parking deck, and that no expansion of parking would take place without concurrence from the town.

Members of the Citizens Advisory Committee commented that the stations proposed have insufficient capacity to the east of Route 495, and excess capacity to the west of Route 495. The MBTA was asked to look into whether more of the demand from the eastern communities could be met by modifications to the Worcester Extension plans.

Mr. Chang was thanked and applauded for his presentation and responses to the Citizens Advisory Committee.

Millbury Station Update

The Millbury station will be evaluated as part of the Worcester Commuter Rail Extension Draft Environmental Impact Report. Both the Route 20 and Route 122 access alternatives will be given equal study. Mr. Eng pointed out that the choice of access route was a major policy decision which would be made by MBTA management based on several factors including cost.

Forbes Community Center
9 East Main Street
Westborough, Massachusetts

MINUTES

Station Site Visit

After discussion, it was agreed that a bus tour of the station sites would be arranged for the morning of Saturday, June 5th. Fifteen CAC members indicated they would be able to attend. A detailed itinerary will be developed and mailed to all CAC members and press.

CAC Schedule

Members of the CAC are requested to submit their comments on Chapters 7, 8, 9 and 16 to Carol Dwyer by Wednesday, May 19. The collected comments will be mailed to all CAC members before May 25. The next meeting of the CAC will take place at the Westborough Senior Center at 7:00 on Tuesday, June 1.

The meeting was adjourned at 9:45.

Attending:

Members of the Citizens Advisory Committee;
Patricia Austin, Kathy Bartolini, Ed Bates, Lydia Bogar, Bob Gentile, Larry Gomes, Dex Malone, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Peter Stanton, Wayne Theis, George Tetler and Randy Waterman.

MBTA Staff:
Jim Eng and Rocco Mancini

Edwards and Kelcey Staff:
Carol Dwyer, Jim Herlihy and Bob Joseph

Also Attending:
Yong B. Chang, Central Transportation Planning Staff; Jeff Dore, Chair of the Millbury Advisory Committee; Penny Kelly; Chris Sinacola, Worcester Telegram and Gazette; and Barbara Smith, The Westborough Chronotype.

Members of the CAC who were absent:
Matt Amorello, Pat Murphy Capone, Maureen Halloran Castillo, Steve Doret, Jay Duncan, Jim Falconi, Margaret A. Lavallee, Judy McCabe, Fred Moseley, and Mary Snyder.

prepared by:
Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, June 1, 1993

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

The meeting was called to order at 7:15.

The minutes of the meeting of May 11 were approved.

Bus Tour

A bus tour of the proposed station sites will take place on Saturday morning, June 5. The purpose of the tour is to give CAC members an overview of the sites, the access roads to the sites, and the land use context of the proposed station locations. The bus route for the tour was described, and an alternate route was suggested traveling from Flanders Road in Southborough to East Main Street in Westborough, and then to Milk St, Fisher Street and Otis Street to the Westborough site.

Millbury Site

A member asked about the status of the Millbury site, and was told that stations on both sides of the track with access from Route 122 and Route 20 will be evaluated in the Draft EIR.

Interim Service

It was asked if a full EIR is required to permit interim service between Framingham and Worcester. Bob Joseph explained that the "Major and Complicated" designation makes it possible to segment the project, and that it would be possible for the Secretary of Environmental Affairs to allow some portion of the project to proceed before all environmental evaluations were completed.

MINUTES

Review of Sections 7, 8, 9 and 16 of the Draft EIR

Written comments submitted by Lydia Bogar, Dave Robbins and John Reil were discussed and members of the CAC commented on Sections 7, 8, 9, and 16 as follows:

A doubling of pedestrian traffic in the South Station area has been observed. It was asked if the reason for this increase was known, and if there would be pedestrian walkways built over the roads from the second level at South Station. Jim Eng will investigate these questions.

The method of assigning traffic to particular streets from the CTPS figures and the towns of origin was explained. Bob Joseph said that all intersections which have an 10% increase in traffic must be examined by EOEA regulations. It was suggested that the intersection of Rt 135 and Rt 85 in Hopkinton be analyzed.

Bob Joseph explained that traffic assignments assumed rail riders to be new or additional vehicles but actually most of these drivers might be just taking a different route. The method makes the analysis conservative in that there may actually be less traffic than estimated. He said that the more serious issue is the growth over time at a station based on a percentage growth in traffic each year. This will be indicated in a comparison of the "no build" and the "build" projections.

There is extensive residential development planned in Ashland and Hopkinton. Bob explained that any project with an EOEA number has to be considered in the analyses. If CAC members have information about other significant development, it would be helpful if submitted in writing to E&K.

It was questioned what portion of the ridership is predicted to come from present bus riders and what portion from new riders transferring from single occupancy vehicles.

It was asked if vanpools beyond the Worcester corridor had been included in the draft analysis. Lydia Bogar is aware of three other vanpools, with one from Chicopee to Quincy, one to Cambridge and one to the South Station area.

Jim Eng said he would find out if there were documentation about the effect of rail stations on town land values.

A CAC member spoke of an argument that commuter rail encourages sprawl development.

The missing sections of Chapter 9 will be produced when the reports of subcontractors on noise, air quality, and soil testing are available.

The present level of railbed pollutants was questioned.

MINUTES

Reverse Commute

CAC members asked for the MBTA's response to the following questions about reverse commute:

What are the reverse commute numbers and the cost differencial of building the system with and without reverse commute?

What are the operating costs related to reverse commute?

Are there locomotives available for reverse commute? Is track time available for the outbound trains, and is reverse commute logistically feasible?

Is reverse commute financially feasible based on a percentage of the existing employees traveling to Worcester?

CAC members requested the potential demand for reverse commute ridership from Boston to Worcester and from Framingham to Worcester.

Jim Eng said he would provide the schedule of trains and the relationship of the schedule to operating costs.

Kathy Bartolini noted that by next Fall all employers of over 100 employees will have to create plans which mandate ride sharing, and that this might encourage the development of car and vanpools from the stations to employment sites. There are 114 employers in the Metrowest area working on these plans presently to meet a November 15 deadline.

Schedule for the Draft EIR

Jim Eng said that parts of the remaining chapters would be available in two or three weeks.

The next regular meeting of the CAC will take place on Tuesday, June 22 at 7:00 at the Westborough Senior Center in Westborough.

The meeting was adjourned at 9:45.

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

Attending:

Members of the Citizens Advisory Committee:

Senator Amorello, Kathy Bartolini, Ed Bates, Lydia Bogar, Margaret A. Lavallee, Dex Malone, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Mary Snyder, Peter Stanton and Randy Waterman.

MBTA Staff: Jim Eng

Edwards and Kelcey Staff: Carol Dwyer, Jim Herlihy and Bob Joseph

Also attending: Jeff Dore, Chair of the Millbury Advisory Committee; David S. Goldman, Hopkinton; Carlene Hempel, Middlesex News; Penny Kelly; Elizabeth C. Merrylees, Framingham; Dave Rize, Office of Senator Amorello; Barbara Smith, The Westborough Chronotype; and Carole Williams, Westborough News.

Members of the CAC who were absent: Patricia Austin, Pat Murphy Capone, Steve Doret, Bob Gentile, Larry Gomes, Maureen Halloran Castillo, Jim Falconi, George Tetler and Wayne Theis.

prepared by: Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, June 22, 1993

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES (Amended)

The minutes of the meeting of June 1, 1993 were approved.

Slide Presentation A slide show reviewing the proposed station sites and June 5th CAC bus tour was presented by Bob Joseph.

CAC Draft EIR Review Procedure and Schedule

CAC members expressed disappointment about the unexpected delivery of the Draft EIR on June 15, because it appeared that the MBTA was ignoring the CAC's questions and concerns that have been asked in the past. Questions from CAC members about MBTA policy issues regarding reverse commute, operations and assessments have not been addressed. The June 15 delivery of the DEIR triggers a thirty day review period which is anticipated to be insufficient for a thorough review. It was suggested that rushing the review would increase negative reactions in the station communities, and be counter-productive to progress of the project.

Representatives of the T were asked to share the MBTA's expectations about the review. Diana Parcon outlined a schedule of review by the CAC and submission to the Secretary of Environmental Affairs on July 15; notice in the Environmental Monitor ten days later, followed by 60 days of public review, and a subsequent decision by the Secretary as to the adequacy of the Draft. Rocco Mancini suggested that the General Manager of the MBTA could be asked to postpone submission of the Draft until July 30th. The CAC voted unanimously to request that the Chair write to request the General Manager of the MBTA provide a 15 day extension of the CAC's review period to July 30th, and send a copy of his letter to the Secretary of Environmental Affairs.

There was a discussion about the review process and the possibility of giving emphasis in the review to those chapters of the draft dealing with interim service. It was pointed out that the CAC may continue to review and comment on the Draft EIR during the sixty day public review period. One member commented that some of the information in the draft must have been available and was concerned that it had not been distributed earlier to the CAC for their review. He asked a

commitment from the MBTA that information would be given to the CAC in a timely manner.

It was noted that the court agreement with the Conservation Law Foundation on the Central Artery commits the MBTA to study the feasibility of the Worcester Commuter Rail Extension by December 31, 1995 and if found feasible, to commence construction by December 31, 1996.

Kathy Bartolini asked the MBTA representatives to explain why there was a need for fast tracking interim service to Worcester. Rocco Mancini replied it was needed for Central Artery mitigation and to fulfill obligations for Massachusetts' implementation of the Clean Air Act. Kathy questioned the numbers of cars that would be reduced, since many of the anticipated Worcester rail commuters were now riding the Peter Pan bus. Rocco Mancini commented that Central Artery construction would begin in 1994, and that experience with the Old Colony pointed out the need for moving forward on the project as quickly as possible.

It was noted that the impacts of interim service on the proposed station communities had not been addressed and needed to be assessed. It was pointed out that sound and vibration impacts for interim service to Worcester would be greater than those impacts for service with local stations.

Mike O'Bryan made a motion that the Chair write to the Secretary of Environmental Affairs asking if the submission on June 15 constituted a legal beginning of the review period. A discussion followed. It was noted that segmentation could only occur after the initial comprehensive Draft EIR was submitted. The CAC can ask for revisions of the draft, and can additionally make comments directly to the Secretary of Environmental Affairs. Dave Robbins noted that some of the revisions will need to be made before public review of the Draft. The Secretary of Environmental Affairs' office has said that it is up to the CAC the way they wish to review the Draft document.

The first part of Mike O'Bryan's motion to find out from the Secretary about the legality of the review period beginning June 15th was carried. The second part of the motion asking guidance from the Secretary on deferring review of Sections 6, 11-16, and Section 18 to a later time, failed to receive a majority vote.

David Robbins outlined the issues which need to be reviewed as priorities by the CAC:

1. A determination of how much of the scope is addressed in the Draft EIR.
2. How well does the Draft cover broad issues such as justification for the project.
3. A review of revisions to the draft addressing comments made to date by the CAC.
4. Close attention to those sections describing the right of way, layover facilities and operations which are related to interim service.
5. MBTA assessments on the corridor communities.

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES (Amended)

The following comments and suggestions were offered. Lydia Bogar asked to have the MEPA regulations sent to each CAC member. George Tetler suggested that if subcommittees were formed, they not include people who are not members of the CAC or town commuter rail committees. It was suggested that CAC members make their comments about each section on a different sheet of paper to facilitate the logistics of review. A suggestion was made that a chart of all mitigation recommended in the Draft be prepared.

It was agreed that the commuter rail committees in each town would review the section concerning their town's proposed station and that the Chair of those groups report back to the CAC.

The meeting was adjourned at 9:45 pm.

The next meeting of the Citizens Advisory Committee will be held Tuesday, July 6th at 7:00 at the Westborough Senior Center.

Attending:

Members of the Citizens Advisory Committee:

Kathy Bartolini, Ed Bates, Lydia Bogar, Bob Gentile, Larry Gomes, Margaret A. Lavallee, Dex Malone, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, George Tetler, Wayne Theis, and Randy Waterman.

MBTA Staff:

Jim Eng, Diana Parcon, and Rocco Mancini.

Edwards and Kelcey Staff:

Carol Dwyer, Jim Herlihy and Bob Joseph

Also Attending:

Steve Bishop, Millbury Town Planner; David Dunham, Worcester Redevelopment Authority; David S. Goldman, Hopkinton; Carlene Hempel, Middlesex News; Anne Merloni, Southborough; Lidia A. Tuley, Southborough; Carole Williams, Westborough News.

Members of the CAC who were absent:

Senator Amorello, Patricia Austin, Pat Murphy Capone, Steve Doret, Maureen Halloran Castillo, Jim Falconi, Mary Snyder and Peter Stanton.

prepared by: Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, July 6, 1993

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

The following documents were distributed: Citizen Advisory Committee Comments Received 7/1/93 - 7/6/93 (E. Bates, L. Gomes, J. McCabe, M. O'Bryan, M. Snyder, and R. Waterman); Letter of July 6 to David Robbins, Chair, from Kathy Bartolini with her comments; Letter of July 6 to Dave Robbins, Chair, from Steve Doret with his comments; Memo of July 6 from Ed Bates; Memo to CAC from Ashland Rail Committee; and Letter to Anne Larner, Executive Director of the MBTA Advisory Board from John J. Haley, Jr., General Manager, with estimates of the impact of Worcester Commuter Rail assessments on communities within the (T) District.

The meeting was called to order at 7:40 pm

Minutes of June 22, 1993 Meeting

The Minutes of the meeting of June 22 were amended by Kathy Bartolini on four points: a fifth priority issue was added to those outlined by David Robbins regarding the MBTA's response to the CAC's questions about future assessments; a notation that the court agreement with Conservation Law Foundation on the Central Artery commits the MBTA to study the feasibility of the Worcester Commuter Rail Extension by December 31, 1995, and if found feasible, to commence construction by December 31, 1996; a statement that the impact of interim service on the proposed station communities has not been addressed and needs to be assessed; and a notation that the Appendices to the Draft EIR were requested for review by the CAC. The motion to approve the minutes was tabled until the next meeting.

CAC Review Schedule

Rocco Mancini announced that the Draft EIR would not be submitted to the Secretary of Environmental Affairs before July 30th. In response to a question, Dave Robbins said that he has not been able to determine the legal status of June 15th as the starting date for CAC review.

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

Draft EIR Review

The CAC reviewed a portion of members comments on the Draft EIR, noting those that it hoped the MBTA would be able to revise for the July 30th submital ("R"), and those which would require more time for comment ("C").

It was noted that Secretary of Transportation Kerasiotes had stated in Worcester recently that there would be interim service to Worcester by October, 1994, even if that meant using AMTRAK trains.

Specific justification for interim service was requested.

It was suggested that the primary justification for the project is to get people out of single occupancy vehicles, and that the needs and costs should be considered together.

The 1992 Annual Report of the Central Artery Environmental Oversite Committee is available from MAPC, and should be referenced in the Worcester EIR.

A member of the CAC felt that the need had not been demonstrated for 800 foot platforms. He felt that concentrating on lowering operating costs did not justify large capital costs.

It was noted that 2,500 riders were not documented in the report presently.

The MBTA was asked to explain the operational requirements for two tracks in the Draft EIR, and Jim Eng said that this would be done.

The potential for ridesharing to complement use of the commuter rail was requested.

It was requested that reverse commute costs be included in revisions to the Draft before submittal to the Secretary of Environmental Affairs.

Specific locations of fencing were requested.

One CAC member noted that sound, vibration and safety issues for the rail line east of Framingham had not been included in the scope of work.

As there was insufficient time to review more than a small number of CAC comments, the process for review in the next three weeks was discussed. It was suggested that a revised draft would be available for review by the CAC on July 20th, before its submission to MEPA on July 31st. The Chairman noted that the CAC needs time to review the revised draft and then summarize their comments for submittal to MEPA, so that the CAC's comments can be distributed with the Draft EIR.

MINUTES

It was questioned if the project needed to be at the 30% design stage for Draft EIR submittal, and Rocco Mancini said it was not necessary for a Major and Complicated project.

The consultants were requested to review the Draft EIR and make the editorial changes and those revisions which are possible to be made in two weeks, and to present those sections of the Draft to the CAC with the Appendices.

It was requested that all CAC comments to date be collated in a single document.

It was asked if mitigation would be included in the Draft EIR. Members noted that while options for mitigation were discussed, there were no commitments offered in the Draft EIR.

The Meeting was adjourned at 9:55 pm.

The next meeting of the CAC will be on Tuesday evening, July 27, 1993 at the Westborough Senior Center at 7:00 pm.

Attending:
Members of the Citizens Advisory Committee:

Senator Amorello, Patricia Austin, Kathy Bartolini, Ed Bates, Lydia Bogar, Steve Doret, Bob Gentile, Margaret A. Lavallee, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Mary Snyder, George Tetler, Wayne Theis and Randy Waterman.

MBTA Staff:

Jim Eng and Rocco Mancini.

Edwards and Kelcey Staff:

Jim Herlihy and Carol Dwyer.

Also Attending:

Dan Cohen, Worcester Telegram; Jeff Dore, Chair Millbury Advisory Committee; Bill Brewin, Marlborough; Karl Gross, Member of Ashland Rail Committee; and Carlene Hempel, Middlesex News.

Members of the CAC who were absent:

Pat Murphy Capone, Maureen Halloran Castillo, Larry Gomes, Jim Falconi, and Peter Stanton.

prepared by: Carol Dwyer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, July 27, 1993

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

The meeting was called to order at 7:15 pm.

The revised minutes of the meeting of June 22 were approved. The Minutes of the Meeting of July 6 were approved as drafted.

CAC Review Schedule

Michael O'Bryan made a motion that the CAC request from MEPA that the thirty day CAC review of the Draft EIR begin on July 20th rather than June 15, to allow the committee time to review the documents and their comments before submittal to MEPA. Rocco Mancini said that the MBTA did not believe they could submit the document by July 30th, and so were targeting submittal for August 15. This schedule would give the CAC seventy five days to give further review to the documents, submit additional comments, and make their recommendations to the Secretary of Environmental Affairs. Dave Robbins has been assured that CAC comments will be given due consideration in MEPA review. It was decided that the motion would be considered after review of the CAC comments.

CAC Comments Review

The Citizens Advisory Committee reviewed the summary of 305 CAC comments prepared by David Robbins, and David's recommendations about deleting or revising comments to reflect changes made in the Draft EIR. It was noted that changes in the Draft had been made in response to 89 of the comments of the CAC.

The CAC reviewed the comments by section, recommended deletions or revisions, and made the following additional comments:

In connection with comments G.4 and G.5 there should be more emphasis on reducing single occupancy vehicles, on other roads besides the Mass Pike, such as Routes 9, 20, and 30.

Reverse commute needs further explanation and justification.

MINUTES

The need for double tracking should be explained from an operational point of view, in addition to any need for double tracking because of reverse commute.

The MBTA's position on pedestrian underpasses needs to be clarified.

The MBTA's plans for station boundary fencing was not clear to the committee.

Mike O'Bryan said the train schedule as proposed in the Draft EIR was unworkable.

In a discussion of traffic impacts, it was pointed out that MEPA requires that intersections be studied where project generated trips are anticipated to create a 10% or greater increase in total traffic. Concern was raised that some intersections and road segments within the study area which should have been analyzed, currently have a high volume of traffic and thus would not meet the 10% criteria.

It was again suggested that a paragraph in the Draft EIR should spell out the mitigation being offered for project impacts.

It was commented that the tone of the collated CAC comments suggested that Westborough did not want any station. Westborough representatives explained that there were diverse opinions and concerns about this issue in Westborough.

It was agreed that the comments which will be submitted by the CAC will be accompanied by an explanation by David Robbins that the comments were made by individual members of the CAC and although generally agreed to by the CAC, were not the results of a true consensus process.

Kathy Bartolini commented that the MBTA is not bound by local wetlands by-laws. However, it has been observed that state agencies are usually willing to comply with local regulations.

It was suggested that increased residential development might result from development of commuter rail and that the comment made in relation to Grafton be made a generic comment, applicable to each site.

The committee agreed that the dates and conditions under which traffic counts were taken were critical and should be included in the Draft EIR. It was pointed out that the traffic counts on Route 85 had been taken at a time when there was a detour from I 495 onto Route 85. This temporary detour may have increased the traffic on Route 85 so that the total volume was artifically large which would reduce the likelihood of a 10% increase in project generated traffic triggering MEPA review.

Dex Malone offered to revise the comment on Section 6.6.

MINUTES

Vote on CAC Review Schedule

There was further discussion of the motion to make a request of MEPA that the beginning date of the CAC one-month review be July 20th, the date on which the revised documents and Appendices were distributed to the CAC. Some members felt that this extension would not give adequate time to make substantive changes in the CAC's comments, but that the public comment period to mid October would be sufficient for the CAC to make comments to the Secretary and a collective recommendation on the adequacy of the Draft EIR.

It was agreed that the Chairman would note in his cover letter that the CAC had received the final draft on July 21st and had inadequate time for review.

The vote on the motion was 7 for and 7 against with two abstentions, causing the motion to fail.

Dave Robbins agreed to make the revisions in the CAC comments as directed by the CAC.

Archeology Sections of the Draft EIR

The CAC agreed to have the archeology sections submitted by Timelines, Inc. on July 21 replace the sections of the Draft EIR which was distributed to the Committee on July 20th.

CAC Requests

Kathy Bartolini requested that the handouts on the assessments of present MBTA communities be analyzed and explained to the CAC, with particular attention to the projected cost recovery of this project noted which does not match the figure used in the Draft EIR.

Pat Austin asked if a representative from MEPA could come to discuss the CAC's continued role in the review process.

Kathy Bartolini repeated a request for a determination if the environmental process had been completed for the Framingham parking.

ENF issued on Union Station

It was noted by Randy Waterman that an Environmental Notification Form for Union Station had been issued.

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

Thanks to David Robbins

The Citizens Advisory Committee requested that the Minutes of the Meeting express their appreciation for the fabulous job by David Robbins preparing the CAC comments for review by the committee.

The meeting was adjourned at 10:30 pm.

The next meeting of the CAC will be held on Tuesday evening, August 24th at 7:00 pm at the Westborough Senior Center.

Attending:

Members of the Citizens Advisory Committee

Senator Amorello, Patricia Austin, Kathy Bartolini, Ed Bates, Lydia Bogar, Bob Gentile, Larry Gomes, Margaret A. Lavallee, Dex Malone, Fred Moseley, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak, Peter Stanton, Wayne Theis and Randy Waterman.

MBTA Staff:

Jim Eng and Rocco Mancini.

Edwards and Kelcey Staff:

Frank Astone and Carol Dwyer

Also Attending:

Jacqueline Cox, Westborough; Dan Cohen, Worcester Telegram and Gazette; Barbara and Ed Headberg, WGAT (Westborough Cable); Carlene Hempel, Middlesex News; Walter and Gina O'Connor, Shrewsbury; and Cathi Connelly Tuminen, Shrewsbury.

Members of the CAC who were absent:

Pat Murphy Capone, Maureen Halloran Castillo, Steve Doret, Jim Falconi, and Judy McCabe.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, August 24, 1993

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

The meeting was called to order at 7:15 by Kathy Bartolini, Vice Chair of the Citizens Advisory Committee.

The minutes of the meeting of July 27 were approved.

Town Updates

Each town was asked to give a brief update on any major events which have taken place since the last CAC meeting in their town.

Ashland: The Board of Selectmen is considering use of the Nyanza site on the north side of the tracks from the Pleasant Street site for parking. The Ashland Advisory Committee has reaffirmed their choice of a site in the general area of the selected site on Pleasant Street.

Southborough: Southborough CAC members and Town staff met with the MBTA in Boston to reiterate their questions about traffic, and mitigation, and to raise a concern about the intersection of Routes 30 and 85, which is reported to be near failure in the EIR on a proposed Route 495 Marlborough/Southborough interchange.

Westborough: The Selectmen have written a letter to the MBTA, the Secretary of Transportation and their state legislators expressing concern that no mitigation has been proposed for Westborough. The Westborough Selectmen do not agree to a station at this time, but are meeting this evening with John Haley.

Grafton: CAC members met with the Grafton Selectmen in June, and the town continues to support a station.

Millbury: The Advisory Committee will meet to comment on the Draft EIR. The Millbury Selectmen oppose a station in Millbury at this time.

Worcester: The scoping session for the Union Station project was held on August 19. Kathy Bartolini attended and Dave Robbins wrote a letter commenting on the need for coordination between the Union Station and Commuter Rail Extension projects.

MINUTES

Draft EIR Filed

The final Draft Environmental Impact Report with its Appendix was distributed to the CAC. Notification appears in the August 24 Environmental Monitor which begins the 60 day comment period. Copies of the DEIR were mailed on August 25 to those CAC members not in attendance.

MBTA Assessments and Cost of Service

The following were distributed: (1) Letter to Anne Larner, Executive Director of the MBTA Advisory Board from John J. Haley, Jr., General Manager of the MBTA regarding estimates of the impact of the Worcester Commuter Rail Extension on assessments to the communities within the (T) District; (2) a one-page graphic describing the MBTA Assessment Procedure developed for the MetroWest Growth Management Committee; (3) a summary of the Estimated Annual Operating Costs and Revenues for the Worcester Extension, projected bond payments from 1993 to 2023, and estimated allocation of state aid for the calendar year 1992, prepared by Jerry Kennedy, MBTA Finance.

Anne Larner explained that the MBTA Advisory Board was set up at the same time as the MBTA in 1964 to review line items in the budget of the MBTA for the 78 cities and towns in the MBTA district.

Responding to a question about changes in legislation which would affect the Worcester Rail Extension communities, Anne Larner said it will be difficult to arrive at a win-win situation which addresses inequities in the costs assessed to towns inside and outside the district, and within the MBTA district where payments may not be proportional to use.

Jerry Kennedy suggested that a special sales tax might be needed.

The MBTA was asked about the estimated revenue to cost ratio for the Worcester Rail Extension. Jerry Kennedy said that the Commuter Rail Operations Staff have estimated operating costs of the line from Boston to Worcester are $12 million ($6.1 million outside the MBTA district and $5.9 inside the district) and the anticipated revenues are $5.1 Million ($1.2 million outside the district and $3.9 million inside the district). This estimated cost recovery for the Boston to Worcester line of approximately 43% compares favorably with the cost recovery for the entire system which is between 36% and 37%.

Layover Facility

A summary of facts about the layover facility prepared by Kathy Bartolini from the Draft EIR was distributed. It was pointed out that Lady of Mt. Carmel Church and Elderly Housing is a sensitive receptor, but that no mitigation is proposed. Air quality impacts are documented but no mitigation is suggested, and the 173 parking spaces at the interim facility are inadequate.

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

Union Station ENF

A letter from David C. Robbins to the Secretary of Environmental Affairs requesting coordination of the Worcester Rail and the Union Station projects was distributed. It was suggested that the Secretary of Environmental Affairs require communication to assure that the interrelationships between these two projects are recognized and addressed. George Tetler offered to assist in relaying information about both projects.

Route 9/Otis Street Intersection

Fred Moseley, a traffic engineer by profession, distributed a memo regarding his traffic analysis of the Route 9/Otis Street Intersection. The results of his analysis are consistent with the Levels of Service presented in the DEIR.

The next meeting of the Citizens Advisory Committee will be held on Tuesday evening, September 21st at 7:00 pm at the Westborough Senior Center (not on September 14 as originally planned).

The meeting was adjourned at 8:45 pm.

Attending:

Members of the Citizens Advisory Committee: Patricia Austin, Kathy Bartolini, Ed Bates, Margaret A. Lavallee, Dex Malone, Judy McCabe, Fred Moseley, Mike O'Bryan, John A. Reil, Edward J. Ropiak, and Wayne Theis.

MBTA Staff: Jerry Kennedy and Rocco Mancini

Edwards and Kelcey Staff: Jim Herlihy, Bob Joseph and Carol Dwyer

Also Attending: Charles Gaffney, Southborough Planning Board; Brian Gould, Representative Kollios' Office; Anne Larner, Executive Director of the MBTA Advisory Committee; Deborah McKenna, Middlesex News; David Rice, Senator Amorello's office; and Janet Slovin, Worcester.

Members of the CAC who were absent: Senator Amorello, Lydia Bogar, Pat Murphy Capone, Maureen Halloran Castillo, Steve Doret, Jim Falconi, Bob Gentile, Larry Gomes, David C. Robbins, Peter Stanton, and Randy Waterman.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, September 21, 1993

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

The Meeting was called to order at 7:20 pm. The Minutes of the meeting of August 24, 1993 were approved.

It was reported that Jollene Dubner was unavailable to meet with the CAC this evening.

Town Updates

Southborough: The local advisory committee will meet on September 23, and later with the Board of Selectmen.

Westborough: The Selectmen have recommended that no station be planned for Westborough without MBTA commitments regarding mitigation and assessments.

It was reported that the Town of Westborough has asked Senator Amorello to file legislation that no station be built in Westborough, and excluding Westborough from assessment.

Grafton: Committee members met with the Selectmen, and there is concern about assessments and about mitigation for houses close to the track.

Grafton members will review old traffic studies and cross check figures in the Draft EIR.

It was noted that 50% of the traffic accidents (40 accidents) are in the Grafton Station study area.

Millbury: The Millbury Advisory Committee is addressing its concerns to the Selectmen and to MEPA.

One Selectman has suggested legislation to prohibit assessments on the town.

Worcester: MEPA is requiring a full EIR on Union Station.

The Central Massachusetts Regional Planning Commission discussed the Worcester Rail Extension Project at its meeting on September 9. No federal funds are requested for this project. A letter of October 12 from the CMRPC Chairperson and Executive Director, and the Commission's minutes of the September 9 meeting are attached, amending these minutes as originally drafted.

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

Review of Station Site Chapters of the DEIR.

It appears that most of the towns have or will submit their comments on the station sites to MEPA before the October 25 deadline. It was agreed that additional CAC comments on those chapters might be redundant or confusing.

Interim Service

The MBTA was asked about the interim service expected to come on line in 1994. Jim Eng explained the tentative plan. Conrail would dispatch between two and four rush hour trains leaving Worcester in the morning and returning in the evening. It is not anticipated that the second track and new signals will be installed before interim service begins. Mr. Eng pointed out that since the track is owned by Conrail, interim service is predicated on MBTA train operations fitting into Conrail and Amtrak schedules.

Planning for Completion of CAC Review of the Draft EIR

The CAC discussed the desirablity of submitting comments as a committee to MEPA. It was decided the CAC would make a recommendation about the adequacy of the DEIR, and clarify and reinforce important issues which had been raised in the detailed comments submitted with the Draft EIR. David Robbins was asked if he would draft a letter for review by the CAC. Some subjects suggested for inclusion in the letter were interim service, assessments, and impacts on remaining stations if one or more stations are not built.

It was agreed that members of the CAC would submit their suggestions for the letter to Dave Robbins by September 28th, and that Dave would distribute a draft letter to CAC members before the next meeting.

Bob Joseph pointed out that the project proponents would much prefer to move forward with a Final EIR that included those subjects which have not been adequately addressed in the DEIR, and that a Supplemental Draft could be a roadblock to the project.

The next meeting of the CAC will be held on October 19 at 7:00 pm, Westborough Senior Center (not October 12 as originally planned).

The meeting was adjourned at 8:45 pm.

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

Attending:

Members of the Citizens Advisory Committee:

Senator Amorello, Lydia Bogar, Jeff Dore, Bob Gentile, Judy McCabe, Fred Moselley, Mike O'Bryan, John A. Reil, David C. Robbins, Peter Stanton, George Tetler, Wayne Theis, Randy Waterman and Jody Young (replacing Mary Snyder).

MBTA Staff:

Jim Eng

Edwards and Kelcey Staff: Bob Joseph and Carol Dwyer

Also Attending:

Jerry Borelli, Ashland; John F. Cahill, Westborough Selectman; and Marsha Platt, State Representative.

Members of the CAC who were absent:

Patricia Austin, Kathy Bartolini, Ed Bates, Pat Murphy Capone, Maureen Halloran Castillo, Steve Doret, Jim Falconi, Margaret A. Lavallee, Dex Malone, and Edward J. Ropiak. Larry Gomes has resigned from the Citizens Advisory Committee.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, October 19, 1993

Westborough Senior Center
East Main Street
Westborough, MA

MINUTES

The meeting was called to order at 7:15 pm. The minutes of the meeting of September 21, 1993 were amended regarding the September 9th meeting of the Central Massachusetts Regional Planning Commission. A letter of October 12 from the CMRPC Chairperson and Executive Director to Ms. Dwyer, and the Commission's minutes of the September 9 meeting replace comments about the meeting in the CAC's minutes.

Town Updates

Ashland: Representatives of the MBTA, Edwards and Kelcey, EPA, DEP, and members of the Ashland Advisory Committee and Board of Selectmen had a productive meeting about Ashland station siting issues. The discussions have not been concluded, but there is a willingness to consider use of the Pleasant Street and Nyanza sites.

Southborough: The Study Committee reported to the Southborough Selectman at a public meeting last week. The Selectman voted to recommend a Supplemental Draft EIR. They oppose interim service to Worcester in the belief that most riders would be commuters now using Peter Pan Bus service. The Selectmen noted a lack of proposed rail mitigation, and that no commitments had been made for traffic mitigation in Southborough.

Metrowest Growth Management Committee: Kathy Bartolini, Executive Director of Metrowest Growth Management Committee reported that this Committee will ask for a Supplemental Draft. Metrowest supports the project in concept. The Committee regrets that impacts of the project on Framingham and the towns east of Framingham to Boston were not included in the original scope of work.

Westborough: Mike O'Bryan reported he assumes that the Westborough Selectmen are preparing comments for MEPA. He expressed concern about the environmental review process to date.

Grafton: John Reil reported that Grafton's Traffic Safety Committee has called for another traffic study to determine the impacts on Grafton if there are no stations in Millbury or Westborough.

MINUTES

Millbury: Margaret Lavallee reported that Rep. Kollios and Senator Amorello were meeting with the Selectmen this evening and calling for legislation to preclude MBTA assessment and a rail station in Millbury. She reported that the Town would consider a station using the Route 20 access.

Worcester: Pat Austin reported that the City will comment strongly in favor of the project, and against any linkage with Union Station. Worcester favors interim service in 1994.

Thomas Lenthall, a member of the Joint Regional Transportation Committee commented on project funding. Jody Young, also a member of JRTC, suggested that those interested attend a panel discussion "Everything You Wanted to Know about Funding of Transportation" on December 8, 3:30 pm at 10 Park Plaza. More information is available by calling Patricia at CTPS.

Robert Schwartz, Executive Vice President of Peter Pan Bus Lines, estimated that 40 to 60 Peter Pan jobs could be lost to commuter rail service.

Discussion of the Draft Letter to MEPA

David Robbins explained that he had prepared a draft letter to MEPA based on the comments of the CAC and that he welcomed the Committee's input.

Supplemental Draft EIR

Kathy Bartolini made a motion to amend the letter to request a Supplemental Draft EIR. Kathy commented that the thirty pages of CAC comments on the Draft signaled that the Draft was unacceptable, and that major issues were still unresolved. Dave Robbins noted that a substantial rewrite would be required whether that were in the form of a Supplemental Draft or a Final Environmental Impact Report, and that in either form the questions and concerns of the communities and the CAC should be addressed. The motion to request a Supplemental Draft passed unanimously with one abstention.

Interim Service

Questions about interim service operations and impacts were raised, and it was agreed to include these questions in the CAC's letter.

Impacts on Framingham to Boston Communities

It was noted that impacts of the project on communities east of Ashland were not included in the scope of work. It was agreed that mitigation of noise and safety issues in these communities was of concern to the CAC.

MINUTES

Jim Eng said that an ENF will be filed for Framingham station and parking improvements. The CAC urged coordination between the Framingham and Worcester Commuter Rail projects noting that increased numbers of trains through Framingham might create traffic jams, Worcester commuter rail could impact parking in Framingham, and plans for parking in Ashland and Framingham should be coordinated. At Dex Malone's request, Jim Eng said that the parking studies in Framingham would be made available to Ashland when completed.

Impacts on Jobs

It was agreed that the Regional Socio-Economic impacts in the DEIR should include any predicted job losses such as might result from transfer of commuters from buses to trains. Jim Eng was asked to find out the implications of a 13C settlement with the bus companies.

Assessments

Jim Eng was asked if the MBTA intended to provide a financial assessment, and he replied that the type of analysis provided by Jerry Kennedy relative to the MBTA district communities would be provided for the project communities.

Union Station

Dave Robbins reiterated the concerns he had expressed in a letter to MEPA that ridership and parking at Union Station had not been assigned specifically in the scope of either the Union Station or Worcester Rail projects. It was agreed that the Scope of the Union Station project would be mailed to the CAC.

Future of the CAC

It was agreed that the CAC would like to meet with Jollene Dubner or Nancy Baker after release of MEPA's response to the DEIR to clarify membership of the CAC and the future role of the committee.

Draft EIR Process

Mike O'Bryan was critical of the review process and said that honest straightforward and timely answers were needed about what was going to happen and when. Senator Amorello agreed that positive dialogue had broken down, but recognized that the project was in a growth phase, MBTA resources were stretched, and that the process was cumbersome. He called for renewed efforts of all parties to work together.

The meeting was adjourned at 9:45 pm.

MINUTES

Attending:

Members of the Citizens Advisory Committee:

Senator Amorello, Patricia Austin, Kathy Bartolini, Bob Gentile, Margaret A. Lavallee, Dex Malone, Mike O'Bryan, John A. Reil, David C. Robbins, Edward J. Ropiak and Jody Young.

MBTA Staff: Jim Eng

Edwards and Kelcey Staff: Carol Dwyer

Also Attending:

Teresa and Andy Boyce, Hopkinton; David Goldman, Hopkinton; Maureen and Louis Jankouskas, Westborough; Bob Kievra, Worcester Telegram and Gazette; Thomas Lenthall, New England Bus Transportation Association and Member of JRTC; David Rice, Office of Senator Amorello; Al Sanborn, Westborough Cable; and Robert J. Schwartz, Executive Vice President, Peter Pan Bus Lines.

Members of the CAC who were absent:

Lydia Bogar, Ed Bates, Pat Murphy Capone, Maureen Halloran Castillo, Jeff Dore, Steve Doret, Jim Falconi, Judy McCabe, Fred Moseley, Peter Stanton, George Tetler, Wayne Theis, and Randy Waterman.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, December 14, 1993

Forbes Community Center
East Main Street
Westborough, MA

MINUTES

The meeting was called to order at 7:20.

Review: Notice of Project Change and Interim Service

Jim Eng discussed the MBTA's withdrawal of the DEIR and submittal of a Notice of Project Change for interim service. A statement by John J. Haley, Jr., General Manager of the MBTA, "MBTA Plans Interim Rail Service to Worcester, Environmental Review of Local Stops goes Forward" was distributed.

Andrew Brennan, MBTA Environmental Manager, described the environmental process. Due to the holidays, the MBTA requested a thirty day review period rather 20 days, so the comment period will extend to January 8, 1994.

Mike Burns, MBTA Director of Railroad Operations, explained the proposed interim service. Three additional trains are proposed to leave Worcester for Boston in the morning, and return to Worcester in the evening. Two of these trains will be new trains, and one will be an extension of an existing Boston - Framingham run. Negotiations are underway for utilization of an existing railroad yard for a layover facility. The MBTA is in the process of negotiating operating agreements with Conrail and Amtrak.

CAC Questions and Comments on Interim Service

CAC members expressed concern about the impacts of interim service on parking in Framingham, believing that with express service available from Framingham to Boston, more commuters will use the Framingham Station than previously. The MBTA has two separate projects planned for Framingham: improving the station and extending platforms to the west; and expansion of parking.

Asked how long interim service was expected to last, the MBTA replied that it depended on the time needed for environmental review of the other stations. Mr. Davis, a consultant to the MBTA, said it is hoped a preliminary revised DEIR can be submitted to the CAC by late Spring or Summer of 1994, and construction scheduled for the summer of 1995.

To a question about involvement of the CAC, Andrew Brennan stated that the CAC would be active until the Final Environmental Impact Report is submitted.

Operating costs of interim service will be dependent on the contracts now being negotiated with Conrail and Amtrak, and the costs of using existing layover facilities in Worcester. The operating costs should be significantly less than the estimated $2.5 million annual cost for full service operations.

To a question about the availability of equipment, Mr. Burns said that the service now had 58 locomotives in the active fleet, and used 42, leaving a cushion of 16. He expects that 50 new coaches and 13-20 new locomotives will be purchased to meet projected demand in the years 1996 - 2000.

The MBTA was asked if interim service ridership demanded more than three trains, could more trains be added without further environmental review. It was explained that MEPA regulations permit increases in MBTA service, but that a reduction of more than 20% system wide triggers MEPA review.

Regional Station

It was suggested that the Regional Station be studied further in the revised DEIR. Jim Eng explained that the Regional Station remains a long term goal of the MBTA, estimated to cost $20 to $30 million. Two CAC members encouraged the MBTA to prepare plans for a regional station before planning the local stations.

Interim Service and MEPA Review

Andrew Brennan agreed that there will be impacts associated with interim service, but no "new" impacts. The MBTA believes that interim service does not require further environmental review. Dave Robbins, Chair, asked the Committee if the CAC thought interim service required MEPA review, and after discussion it was agreed that no recommendation would be made by the CAC either for or against requiring MEPA review of interim service, but that a list of issues and concerns which needed to be addressed would be forwarded to the Secretary of Environmental Affairs. These issues included: gate closing impacts in Ashland; impacts at layover facilities; parking in Framingham; noise and vibration impacts in Westborough, impacts on express buses from Worcester; assessments, and determination of the service area. It was further agreed by the CAC that any increase from the proposed level of interim train service should require reconsideration of the need for environmental review.

The meeting was adjourned at 9:45 p.m.

Forbes Community Center
East Main Street
Westborough, MA

MINUTES

Attending:

Members of the Citizens Advisory Committee:

Senator Amorello, Patricia Austin, Lydia Bogar, Pat Murphy Capone, Jeff Dore, Bob Gentile, Judy McCabe, Margaret A. Lavallee, Dex Malone, Mike O'Bryan, David C. Robbins, Edward J. Ropiak and Wayne Theis.

MBTA Staff:

Mike Burns, Director of Railroad Operations; Andrew Brennan, Environmental Manager; Jim Eng, Project Manager; Steve Davis, Rackemann Environmental Services/MBTA Consultant.

Edwards and Kelcey Staff:

Frank Astone, Jim Herlihy and Carol Dwyer.

Also Attending:

Craig Blais, City of Worcester, Tom Downey, TAB Newspaper; Charles G. Gaffney, Southboro Planning Board; Karl Gross, Ashland Rail Committee; Carlene Hempel, Middlesex News; David Rice, Office of Senator Amorello; and Mary Frain, Worcester Telegram and Gazette.

Members of the CAC who were absent:

Ed Bates, Kathy Bartolini, Marureen Halloran Castillo, Steve Doret, Jim Falconi, Fred Moseley, John Reil, Peter Stanton, George Tetler, Randy Waterman and Jody Young.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, May 24, 1994

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

The meeting was called to order at 7:15 pm.

Project Status:

The status of the Worcester Commuter Rail Project was reviewed. A Notice of Project Change was submitted in November 1993 and approval for interim rail service was granted in January 1994. Service will begin in the Fall of 1994.

A new Draft EIR is being prepared. All comments received on the August 1993 DEIR are being reviewed in order to respond as fully as possible.

Mitigation:

Types, policy objectives and criteria of mitigation measures will be provided in the Draft Environmental Impact Report. Commitments for definitive mitigation such as for intersections, pedestrian traffic and noise will be provided in the Final EIR.

Ridership Analysis:

Central Transportation Planning Staff (CTPS) is studying ridership figures using information from 1990 census data that was not ready when the earlier analyses were made.

In order to respond to questions about traffic at any one station, in the case that other stations are not built, CTPS plans to assess two scenarios:

1. Traffic at each station if all stations are built.
2. Traffic at each station if that were the only station built (in addition to Worcester).

Figures for each of these scenarios will provide the towns with high and low boundaries within which ridership can be projected. These numbers should be available in mid June.

MINUTES

Ridership for school based travel, reverse commute and special event travel will be included in the Draft EIR.

Project Schedule:

An optimistic schedule for the Draft EIR calls for the document to be 90% complete in mid July, at which time it will be made available for review by the town rail committees. The schedule assumes no external influences which cannot be controlled by the MBTA. The thirty-day review period for the CAC will begin about August 15th, and the Draft EIR will be filed with MEPA in mid to late September. A sixty-day period for comments from the public and concerned organizations will be followed by seven days in which the Secretary of Environmental Affairs determines the adequacy of the document. If the document is filed with MEPA on September 15, the Secretary's decision could be issued about December 1, 1994.

The MBTA will rely on town planners and rail committees as well as the CAC for input during the process.

Final Environmental Impact Reports are anticipated to be prepared for each station individually.

Assessments:

The MBTA does not know how to respond to questions about future assessments for MBTA service in a reasonable and professional way, given that the Legislature and not the MBTA makes these determinations. The MBTA is reluctant to comment about possible future assessments when it is not clear how present and future discussions will be resolved.

Train Schedules:

The MBTA made a commitment (which Conrail approved) to interim service of three morning peak hour trains from Worcester and three evening peak hour trains from Boston.

A reduced full service schedule, with less mid-day service, is being considered in order to mitigate operating costs, costs of equipment and environmental considerations such as noise and traffic at grade crossings.

MINUTES

Discussion:

Rail Service: The MBTA noted that the target for full service is the end of 1996. It is not yet known which trains will be express trains and how the trains will operate between Framingham and Boston.

Assessments:

Southborough wants a station, but needs to understand if MBTA assessments for the service might necessitate cutting other essential services like Fire and Police. The MBTA recognizes that this is a legitimate concern. It was suggested that the MBTA treat this issue in the same way as the issue of ridership will be addressed, providing a range of possibilities.

The MBTA was encouraged to project assessments based on the existing formula with additional lines being added and using CTPS ridership figures.

The MBTA believes that it is impractical to try to predict how the formulas and districts will change, and that figures offered would be unreliable. However, if no figures are provided, communities may be reluctant to agree to a station in their town. It was pointed out that towns could be assessed whether or not they have a station. All towns want to understand the future costs of MBTA service, but this may not be possible since any methodology used may be incorrect.

If anyone has a suggestion about how assessments could be estimated, they are encouraged to contact the MBTA, or their legislator.

Service Costs:

The Draft EIR will provide clearer cost of service figures, and describe the assessable pool. Total costs of the project are anticipated at $80 million. The cost of equipment is estimated at $39 million, for a total cost of $119 million. A concern was expressed that the equipment cost had been lumped into another MBTA budget, thus not specifically labelled as Worcester equipment. Site mitigation costs have been estimated based on experience with the Old Colony line, and have been factored into the $80 million projected cost of the project.

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

Ridership:

Concern expressed that 1990 census data is four years old. But, the trend from 1990 to 1994 seems to indicate that ridership demand is stable or increasing.

North-South Station Rail Link:

Amtrak has received $4 million from Congress to prepare a study of a rail link connecting North and South Stations, including a midway stop. The MBTA is heading up the project and should file an ENF with MEPA shortly. It will be a $2 to $3 Billion project, and there will be a Citizens Advisory Committee appointed.

Other Comments:

An increase in pedestrian traffic at South Station was noted.

Daily traffic on the Massachusetts Turnpike has increased since 1990.

An Environmental Notification Form has been submitted on Park and Ride facilities proposed by the MTA.

A Regional Station is in the scope of the Worcester Rail Project and will be analyzed but will not be proposed.

It was suggested that there was need for a ridership assessment which examined other station combinations in the Ashland, Southborough, Westborough area in addition to the scenarios proposed. Would be in FEIR if appropriate.

The meeting was adjourned at 8:45 pm. The next meeting of the CAC will be held in mid to late July.

CAC Members Attending: Patricia Austin, Ed Bates, Kathy Bartolini, Lydia Bogar, Margaret Lavallee, Dex Malone, Judith McCabe, Mike O'Bryan, John Reil, David Robbins, Edward Ropiak, Wayne Theis and Jody Young.

MBTA Staff Attending: Andrew Brennan, Steve Davis (Rackeman Environmental Service/MBTA), James Eng, and Stephen Roop (RES/MBTA).

Westborough Senior Center
East Main Street
Westborough, Massachusetts

MINUTES

Edwards and Kelcey Staff Attending: Frank Astone, James Herlihy and Carol Dwyer.

Others Attending: Carroll F. Fay, Westborough; Brian Fleming, Senator Amorello's Office; David S. Goldman, Hopkinton; and Bob Kievra, Worcester Telegram.

CAC Members Absent: Senator Amorello, Patricia Murphy Capone, Stephen Doret, James W. Falconi, Robert Gentile, Karl Gross, Fred Moseley, Peter Stanton, George Tetler, and James Waterman.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Worcester Commuter Rail Extension Project

Connecting Worcester and the MetroWest Communities to Downtown Boston

CITIZENS ADVISORY COMMITTEE MEETING

Tuesday, October 4, 1994

Southborough Fire Station
Route 30 (Main Street)
Southborough, Massachusetts

MINUTES

The meeting was called to order at 7:10 P.M. by Kathy Bartolini, Vice Chair of the Citizens Advisory Committee. The minutes of the previous CAC meeting (Tuesday, May 24, 1994) were not read. The agenda for this meeting was prepared by the CAC.

Union Station DEIR

The CAC commented on the previous version of the Union Station DEIR, expressing concern that the Union Station and Worcester Commuter Rail projects each relied on the other to answer parking demand in the immediate area. Noted that only one (1) week remains to comment on the September 1994 Union Station DEIR.

Brief presentation by David Dunham of the Worcester Redevelopment Authority, proponents of the Union Station Project.

- Comment period ends in 5 to 6 days.
- Used the Worcester Commuter Rail DEIR for source data.
- Union Station project includes revised roadways and use by Amtrak, Commuter Rail, local buses. Peter Pan bus, bikers and walkers. Project is multi-modal and pedestrian friendly.
- The station building will be completely rehabilitated, but not fully restored. The twin towers will be rebuilt.

Interim Service, which commenced on September 26, 1994, has been attracting approximately 230 daily commuters boarding at Worcester. This ridership was labelled as being "on target" by the MBTA. Concern was expressed as to whether Peter Pan Bus Company was experiencing a loss of riders. The MBTA will perform ridership surveys once the service has stabilized.

Upon questioning, David Dunham (WRA) explained that the Union Station project was proposing a 500 car parking garage on Worcester Center Boulevard, which in conjunction with 405 parking spaces planned by the MBTA would satisfy the year 2010 demand of somewhat less than 900. Redevelopment demand and commuter rail demand were factored into the answer. The CAC, as a group, is not

likely to comment on the Union Station DEIR. The Central Massachusetts Planning Agency has been involved in the process and will comment.

Regional Station at I-495

A "Feasibility Study of a Regional I-495 Station" is included in the pending State Transportation Bond Bill (sponsored by Sen. Durand). The CAC voted to support this item and wrote a letter of support. According to Matt Day, an aide to Sen. Durand, there is no dollar amount included for the Feasibility Study, only a directive to the MBTA to investigate in more detail and on a fast track basis. Maybe a year or so to report findings. The 'Bill' is in Conference Committee now; the Regional Station Study is not in the House version of the 'Bill'. Sen. Durand feels a Regional Station is the ultimate goal.

Westborough and Southborough support the Regional Station study, and feel that the issue should be resolved prior to commitments for a local station. Some question as to whether all other stations should be put on hold until this issue is resolved. Ridership described in the current DEIR addresses all stations in place and Worcester plus each station individually (including a Regional Station) in order to address lower and upper bounds of ridership for each station. Concern was expressed that without all possible combinations of station possibilities (92 combinations) a Regional Station Study would not be valid if adjacent stations were considered to be in place. It was noted that a Regional Station at I-495 should be studied, although the language in the Bond Bill is too loose. Wetlands (ACEC) and access from the Interstate present serious questions regarding the viability of a station at I-495. Interest was expressed for ridership demand with a Regional Station, but without a Westborough Station or without stations at Westborough and Southborough. Comments on the DEIR could lead to other station combinations being addressed in the FEIR. It was agreed that the CAC should review closely Section 17.0 - Regional Station Analysis.

In order to understand better the ridership forecasts by CTPS, as they related to various station alternatives with and without a Regional Station, the CAC requested that each involved town and each CAC member expressing interest should receive a copy of the DEIR Appendix Vol. I and Vol. II. The MBTA will comply with this request through their Office of Environmental Affairs.

Further discussion of a Regional Station revealed that ridership is projected to be less based on 1990 census data than previously projected employing 1980 census data. In response to a question as to whether 2,500 riders are needed to support the service, the MBTA stated that service can be supported by less than 2,500 riders by providing less service and by spending less on infrastructure.

Southborough Fire Station
Route 30 (Main Street)
Southborough, Massachusetts

MINUTES

CAC Review of the September 13th DEIR

The CAC has 30 days (commencing 10/5/94) to review the DEIR and to submit the official CAC comment letter to Environmental Secretary Coxe. The letter will be bound in the DEIR document which will be submitted to the EOEA-MEPA Unit on November 15, 1994. The public comment period of 60 days will follow.

The CAC will form committees to address major concerns. Individual comments will be welcomed also. Items of discussion included the following:

- Train schedules appear to be in error. Positioning of equipment should be checked.
- Idling time at the Layover Facility was questioned as being too idealistic.
- Recent publicity re: engine noise at the temporary layover facility.
- Request for "full train schedule", including all trains between Worcester and Boston (new service plus existing Framingham Service).
- Service area boundary based on CTPS projections for 28 communities. Certain communities such as Milford and Bolton only apply when a Regional Station is considered.
- Need for the project - discussion re: the SIP and the possibility of a substitute service such as a bus alternative. According to 310 CMR 7.36, must build many mitigation measures for the CA/THT including the Worcester Commuter Rail Extension. If the rail extension found to be infeasible, then can substitute.
- Benefit for rail freight? Is related work for improved clearances in the budget? The MBTA believes that another source of funding is anticipated for improved clearance.
- Discussion of bridge improvements shown in Table 3.1-1 versus the TIP.
- Discussion of costs and revenues--Section 3.6. Concern expressed that the Framingham service has a high cost recovery and that the service extension from Framingham to Worcester would have a relatively low cost recovery.
- Air Quality -- Section 5.5. Concern expressed that expanded train service is more polluting than the comparative bus service alternative (employing NO_x/VOC combination). The CAC will submit written comments on this issue.
- Ridership projections by CTPS prompted no discussion. Regarding Interim Service (which commenced on September 26, 1994), the MBTA stated the ridership is on target.
- Mini-high platforms for handicapped access were questioned relative to MAAB requirements. A brief discussion of the Memorandum of Understanding (MOU) revealed that the MBTA is confident that mini-highs will be acceptable versus full-high platforms.
- The Ashland-East Station raised concern due to the offset platform configuration.

- The MBTA committed to sidewalk construction in Westborough and Southborough, the limits of which have not been determined. For bicycle access, the MBTA will explore funding possibilities with the MHD through possible use of ISTEA funds. Bike lockers were suggested for consideration.
- A brief mention was made of possible impacts between Framingham and Boston, in particular in Natick and Wellesley.
- Pedestrian safety at existing stations with openings in the inter-track fencing was cited as a serious concern. A possible solution - track circuited sliding fence.
- Brief discussion of train noise relative to Figure 7.3-2.

The CAC members were requested to submit written comments addressing the DEIR by Section. The comments are to be faxed to Jane Sherman (Staff Assistant to Andrew Brennan) at the MBTA (Fax 617-723-1969) no later than October 19, 1994. Jane will compile the comments into packages and distribute to all CAC members for use at a CAC meeting on October 25, 1994.

The meeting was adjourned at 9:35 P.M.

Members of the Citizens Advisory Committee Attending: Kathy Bartolini, Ed Bates, Pat Murphy Capone, Bob Gentile, Karl Gross, Margaret Lavallee, Judy McCabe, Mike O'Bryan, John Reil, Ed Ropiak and Jody Young.

MBTA Staff Attending: Andrew Brennan, Environmental Manager; Jim Eng, Project Manager; Steve Davis, Rackemann Environmental Services/MBTA Consultant.

Edwards and Kelcey Staff Attending: Jim Herlihy and Frank Astone.

Also Attending: Glede Browne, Middlesex News; Daniel Cohen, Worcester Telegram & Gazette; Matt Day, Office of Senator Durand; David Dunham, Worcester Redevelopment Authority; David Goldman, Hopkinton resident; David Holbrook, Hopkinton resident; and Bonnie Phaneuf, Southborough resident. (It is likely that one or more others were in attendance, but did not sign the attendance sheet).

Members of the Citizens Advisory Committee Absent: Senator Amorello, Jeff Dore, Wayne Thies, Patricia Austin, Steve Bishop, Steve Doret, Mary MacAdam, Fred Moseley, Peter Stanton, Randy Waterman, Lydia Bogar, Jim Falconi, Dex Malone, David Robbins and George Tetler.

SECTION 8.0

ENF COMMENTS

JD

Massachusetts Audubon Society

South Great Road
Lincoln, Massachusetts 01773
(617) 259-9500

RECEIVED
SEP 15 1992
MEPA

September 14, 1992

Susan Tierney, Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge St.
Boston, MA 02202

Attention: MEPA Unit

Re: EOEA # 9154, Worcester Commuter Rail Extension Project

Dear Secretary Tierney:

On behalf of the Massachusetts Audubon Society, I submit the following comments on the Environmental Notification Form (ENF) for the above referenced project.

The Massachusetts Audubon Society generally supports projects that enhance public transportation options such as commuter rail, where such projects can reduce reliance on automobiles and associated environmental impacts such as air pollution and highway construction. The proposed Worcester commuter rail extension will be a valuable addition to the state's public transportation infrastructure, and has the added advantage of taking place along an existing railroad right of way, requiring improvements and additions to existing facilities rather than entirely new construction. Nevertheless, the project will have significant environmental impacts, including construction of stations and a second track along a portion of the project and filling of .9 acre of wetlands. Since this project will be funded by and serve the public, MEPA jurisdiction should be exercised to the fullest extent, encompassing all areas of environmental impacts. (We also note that the project may be categorically included and require an EIR under 301 CMR 11.25(19) "Any project providing 1000 or more new parking spaces.") An EIR should be completed including analysis of all alternatives in order to develop a design resulting in minimization of environmental impacts.

Siting Alternatives

The EIR should document all alternative designs, alignments, and station locations that have been considered to date as well as any new alternatives that may come to light through the MEPA process. The rational behind each preferred alternative should be fully explained, including what factors (environmental and other, such as site availability, accessibility and ridership attractiveness) controlled these decisions.

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Wetlands

For each location where wetland alterations are proposed, the wetland resource areas should be delineated and maps prepared at a scale of 1"=100' or better. These plans should clearly show all proposed alterations to resource areas and buffer zones as well as any wetland replications areas. The text should explain how the project design in each area involving wetland alterations meets the hierarchy of avoidance, minimization, and mitigation of impacts to these resource areas. The EIR should describe anticipated impacts to wetland statutory values and should show how the performance standards under the Wetlands Protection regulations will be met. Mitigation and replication plans and methods should be described in detail.

The proposed Grafton station site requires a variance for filling over 5,000 square feet of wetland. The EIR should show why the MBTA believes no alternative is available that would reduce wetland impacts for a Grafton station, and should provide a full analysis of the justification for the granting of a variance. If new alternatives for this station which would reduce wetland impacts are brought to light during the MEPA review process, they should be fully explored as well in the EIR.

While the portion of the project running through the Westboro Cedar Swamp Area of Critical Environmental Concern is already double-tracked, the EIR should evaluate any potential increase in impacts to the ACEC's resources as a result of the commuter rail extension project. The MBTA proposes to construct chain link fences along the right of way throughout the 23 mile project length. What will be the impact on wildlife movements and populations as a result of this fencing? The impacts of the fence should be evaluated separately for each location where significant amounts of undeveloped land exist on each side of the track and the fence is therefore likely to become a barrier fragmenting wildlife habitat. Particular attention should be paid to wildlife habitat impacts of the fence in the ACEC and other wetland resource areas. The MBTA should be required to evaluate whether a continuous fence throughout the project length is indeed justified for safety or other reasons, particularly in large wetland areas that are largely inaccessible to human foot traffic.

Rare Species

The ENF gives no definitive response on the potential impact of the project to rare species or their habitat, indicating only that the Mass. Natural Heritage Program is currently reviewing the project. The EIR should show all locations where rare plants or animals might be adversely affected by the project, and should include a full analysis of all rare species impacts. Alternatives and mitigation plans that might avoid or reduce such impacts should also be presented.

Open Space and Recreation

The ENF cites opportunities to increase public access to the Sudbury River in Ashland and Southborough. The EIR should show the proposed design of all proposed open space and recreation access points and associated trails or other facilities that will be developed in

conjunction with the project. Any impacts to wetland resources, rare species habitat, or other critical resources should be considered along with potential recreational benefits for each proposed open space access area.

Stormwater Management

The EIR should include detailed plans for best management practices to handle stormwater management at each station and the overlay facility.

Intermodal Aspects

The EIR should fully describe how the project incorporates intermodal transportation goals. Aspects of the project design that could support transportation alternatives such as bicycles, carpooling, and group transport to and from stations should be examined in the EIR.

Conclusion

This project's size, significant impacts, and public funding provide more than adequate justification for preparation of an EIR scoped to cover the full range of environmental issues. The Society urges MEPA to require preparation of such an EIR, with the scope to address all of the areas outlined above, for the purpose of insuring that all impacts will be minimized.

Thank you for the opportunity to comment.

Sincerely,

E. Heidi Roddis

E. Heidi Roddis
Environmental Policy Specialist

cc: Diana Parcon, MBTA
Conservation Commissions and Planning Boards: Grafton, Millbury, Worcester, Westborough, Southborough, Ashland, Framingham
DEP Central Regional Office
Metropolitan Area Planning Council
Central Mass. Regional Planning Commission

The Commonwealth of Massachusetts

Department of Food and Agriculture

Lancaster Regional Field Office

142 Old Common Road

Lancaster, Massachusetts 01523

Bureau of Land Use
(508) 792-7711
(508) 365-5063

JD

RECEIVED
SEP 1
MEPA

MEMORANDUM

TO: Susan F. Tierney, Secretary
Executive Office of Environmental Affairs

ATTN: MEPA Unit - Jollene Dubner

FROM: Barbara L. Hopson, Land Use Administrator Barbara L. Hopson

RE: EOEA #9154 Worcester Commuter Rail Extension Project

DATE: September 11, 1992

The Department has reviewed the ENF for this project with respect to potential impacts on agricultural land. The second rail will be constructed within the existing Conrail rail corridor and therefore will not impact any agricultural land.

The proposed Grafton station site will be constructed on land formerly part of the Grafton State Hospital which was declared surplus to state need in 1991. The Department of Food & Agriculture managed the lease on three small fields near the junction of Green Street and the Conrail right of way until 1991 at which time it was determined that the agricultural future of these fields was uncertain and the fields were not put out to bid again.

Although state funding is involved in this project, it is the Department's determination that Executive Order #193 does not apply due to the small amount of agricultural land affected and negotiations resulting from the Grafton State Hospital disposition which protect the remaining agricultural land on the property.

JD

RECEIVED
SEP 3 1992
MEPA

City of Boston
The Environment
Department

Raymond L. Flynn
Mayor

Lorraine M. Downey
Director

Boston City Hall/Room 805
Boston, Massachusetts 02201
617-635-4416 or 635-3850

September 1, 1992

Secretary Susan Tierney
Executive Office of Environmental Affairs
100 Cambridge St. 20th Floor
Boston, MA 02202

Attn: Jollene Dubner, MEPA Unit
RE: EOEA #9154, Framingham-Worcester Commuter Rail Extension

Dear Secretary Tierney:

The City of Boston Environment Department has reviewed the Environmental Notification Form (ENF) for the proposed project referenced above pursuant to 310 CMR 11.00, and hereby submits the following comments:

Implementation of this project will help promote the long-standing City goal of improving regional air quality and reducing traffic congestion on metropolitan roadways by developing convenient alternatives to single-occupant private transportation. The Environment Department is thus supportive of the proposed project.

Nevertheless, there will be some negative project impacts. The project should add around sixteen daily train passby events on the existing right-of-way through Boston out to Framingham. This has potential to further increase noise impacts experienced by residents living along the busy public transportation corridor. The MBTA should document the L(max) levels predicted to occur from the new service at various sensitive receptors along the ROW, and should compare existing L(DN) and peak hour L(eq) levels with those expected after project implementation. The noise analysis should also identify the contribution of existing commuter rail trains to the pre-project levels, and should propose appropriate long-term mitigation programs for the cumulative impact of all commuter rail operations.

Similarly, diesel fumes and vibrations will impact many sensitive receptors along the ROW. The MBTA should undertake design of the project so as not to preclude future conversion of the commuter rail line to electric trains. To reduce vibrations, the MBTA should install ballast mats, use wood piles, etc. along the new track in sensitive areas, and should also document what additional vibration impacts can be expected along the existing track from Framingham to Boston.

The project will divert thousands of commuters from highways onto trains, which as stated above is a welcome development. Nonetheless, thousands of pedestrians will now be added to the already chaotic pedestrian environment around South Station and Back Bay station. The MBTA should work with the Boston Transportation Department to ensure that these additional pedestrians can be safely accommodated, and that traffic flow on local streets around the stations will not be significantly impacted.

Despite some concerns about additional impacts in the immediate vicinity of the train corridor, the Environment Department recognizes that the environmental benefits of the commuter rail extension will significantly outweigh the negative impacts for the City of Boston as a whole. The City is also confident that the review process can resolve concerns about station location and wetlands and construction impacts in the area between Framingham and Worcester.

The Environment Department looks forward to implementation of this project, subject of course to the development of an appropriate mitigation package.

I thank you for your time and attention.

Sincerely,

Lorraine M. Downey

Lorraine M. Downey
Director

LMD/AP:ap

cc: Jane Chmielinski, MBTA

BOSTON
TRANSPORTATION
DEPARTMENT

ONE CITY HALL PLAZA
BOSTON, MASSACHUSETTS
(617) 725-4680/FAX

9 September 1992

Susan F. Tierney
Secretary, EOEA
100 Cambridge Street
Boston, MA 02202

Dear Secretary Tierney:

I would like to submit the following comments on the environmental notification form for the MBTA's Worcester Commuter Rail extension project (EOEA No. 9154).

Stations are proposed in five communities located outside the MBTA district: Southborough, Westborough, Grafton, Millbury, and Worcester. The MBTA should examine the financial implications of extending service into communities that do not contribute to its local assessment. The MBTA should also discuss the policy implications of committing resources to extending service beyond its district rather than improving service in the the 78 cities and towns that make up the MBTA district.

In the course of planning this project, the MBTA should review the service needs of the entire rail corridor between South Station and Worcester. The MBTA should look at the potential for establishing new stations in the Allston-Brighton or Fenway-Kenmore neighborhoods of Boston. In addition, the MBTA should evaluate the opportunities for reverse commuting from communities east of Framingham.

Finally, the MBTA should evaluate the operational issues along the corridor. How will commuter rail service be coordinated with intercity and freight service? Will service on the existing Framingham commuter rail line be affected? Can Back Bay and South Station accommodate additional service?

Thank you for this opportunity to comment.

Sincerely,

Richard A. Dimino
Commissioner

RAYMOND L. FLYNN, MAYOR
RICHARD A. DIMINO, COMMISSIONER

MAPC

Metropolitan Area Planning Council

60 Temple Place, Boston, Massachusetts 02111 617/451-2770

Serving 101 cities and towns in metropolitan Boston

RECEIVED
OCT 1 1992
MEPA

September 24, 1992

The Honorable Susan Tierney, Secretary
Executive Office of Environmental Affairs
MEPA Unit
100 Cambridge Street
Boston, MA 02202

Project Identification:
Project Name: Worcester Railroad Extension
Project Proponent: MBTA
Location: Framingham to Worcester
EOEA: 9154
MAPC: ENF-92-108
Received: August 24, 1992

Dear Secretary Tierney:

The Metropolitan Area Planning Council regularly reviews development proposals deemed to have regional impacts. These proposals are reviewed for compliance with MetroPlan 2000, the regional plan for the Boston metropolitan area, as well as for their impact upon the environment. The Council encourages MEPA to ensure that any mitigation complies with MetroPlan 2000.

MAPC's concerns with the proposed Worcester Extension are as follow:

1. Project Justification

The feasibility study suggests that the annual subsidy for this service (annualized capital plus operating and maintenance costs) will be about $9.6 million, or about $8.21 per rider (Table 7 in the feasibility study). This annual subsidy per rider for the rail extension exceeds the total cost per passenger for the bus alternative which we calculate from the feasibility study to be about $8.12. The revenues generated from bus fares is not provided in the feasibility study thus per rider subsidies are not available.

Marjorie A. Davis, *President* Edmund P. Tarallo, *Vice-President* Richard A. Easler, *Secretary* Marylou Batt, *Treasurer*

David C. Soule, *Executive Director*

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We also note that the bus alternative provides for 1,530 daily inbound trips as opposed to the 2,550 daily inbound trips from the Worcester rail alternative. Do the additional 1,020 inbound transit riders justify an $80 million construction investment and an increase in annual operating and maintenance costs of $3.6 million ($5.1 million rail operating costs less a $1.5 million bus operating cost).

Given that the region and the state need to reduce air pollution emissions by 24% before 1999, it is important that we find the most cost effective means of achieving this reduction. This expenditure of funds will result in only a 0.03% reduction in emissions of non-methane hydrocarbons while increasing the MBTA's net deficit by 2.4%.

When MAPC testified on the amendments to the State Implementation Plan for Air Quality we pointed out the need for substitute projects that would have greater air quality benefits for the region. The continued pursuit of the Worcester Rail Extension, given its limited air quality benefits threaten the region's ability to achieve clean air. We recommend that the MBTA, as part of an environmental impact report the MBTA and EOTC be required to study alternatives that could have greater air quality benefits at equal or lower costs.

In order to address air quality and mobility issues in the same corridor as the Worcester Extension we would recommend that additional analysis include:

1) a review of expanded express bus opportunities between Marlborough and Boston;
2) implementation of local bus services within the MetroWest area that might link Marlborough and the Framingham/Natick area; and
3) implementation of local "hub and spoke" bus services in Framingham/Natick and Marlborough that would serve these communities population and employment centers and provide connections to neighboring communities such as Wellesley, Sudbury, Southborough or Waltham and Newton.

2. Worcester Bound Commuter Services

At a public meeting in Southborough, MBTA personnel noted that they were exploring the possibility of scheduling trains to serve morning inbound trips to Worcester and evening outbound trips from Worcester. While we expect that this will increase public transportation use in the Worcester area, and will increase riders on the proposed service, costs will increase. At present most MBTA rail services are designed to minimize "dead head" travel, i.e.

non revenue travel with empty seats. Thus evening layovers are at the destination of the trips out from Boston in the afternoon and daytime layovers are in Boston. To meet the needs of peak hour rail service to Worcester, trains will need to return to Worcester after arriving in Boston in the morning, or return to Boston after arriving in Worcester in the evening. This will increase the number of needed train sets, and the amount of dead head mileage incurred.

If service is desired for the Worcester commute, the Worcester Regional Transit Authority should bear the burden of these added costs.

3. Station Accessibility

Community comments, at both the scoping session and a public meeting in Southborough, have noted a need to ensure pedestrian and bicycle accessibility to all stations. MAPC concurs with these community comments and is willing to work with the MBTA to enhance bicycle access to all stations in our region. We believe that the Southborough Station, with its access to Hopkinton State Forest, could be a major seasonal attraction for bicycle access. The MBTA should promote this aspect of off-peak and weekend rail service.

4. Growth Impacts

A. Regional Station at Interstate 495

Much discussion has occurred regarding a regional station at I-495. The MBTA has noted a difficulty in locating a site due to the existing rail yard for CONRAIL and an Area of Critical Environmental Concern. MAPC notes that the justification for a regional station on Interstate 495 would be to attract trips from this facility to the train service. Before making the decision that an I-495 parking facility is desirable, we recommend that a demand analysis be conducted to determine whether the facility would actually attract existing travellers along I-495 to the rail service, or if it would encourage additional sprawl residential development. If the latter is to occur, the region may experience increased auto travel, rather than decreased travel.

B. Other Growth Impacts

At the scoping session and at the Southborough public meeting commenters noted that the improved accessibility of the area could encourage increased relocation from areas of the region's core to communities served by the rail extension. We recommend that the communities review their local planning goals to develop plans for the station areas that will moderate automobile growth by encouraging housing policies that promote multi-family and small-lot detached

single family homes within walking distance of the proposed rail stations. Some small commercial development station might also be appropriate.

5. Worcester and Framingham Stations

The separation of Worcester and Framingham stations from analysis in this ENF suggests segmentation. The DEIR needs to analyze the total system changes, thus the impacts of these two facilities must be included.

6. Neighborhood impacts

The DEIR needs to pay careful attention to the impacts of traffic in neighborhoods around the stations and identify methods to fully mitigate these impacts.

Thank you for the opportunity to review and comment on this ENF. MAPC looks forward to reviewing the Environmental Impact Report on this project.

Sincerely,

David C. Soule,
Executive Director

cc: Charles Gaffney, Southborough
John Whiteman, Ashland
Steve Kerlin, Ashland
Arthur Noonan, Framingham
Daniel J. Fortier, Chief Transportation Planner
Kent Stasiowski, Project Review Coordinator
MetroWest Growth Management Commission
Central Mass. Regional Planning Commission
Charles Steward, MBTA

MetroWest
Growth Management Committee
13 East Central Street
Natick, MA 01760
508·651·7350

May 26, 1992

Mr. John Haley, Jr.
General Manager
MBTA
10 Park Plaza
Boston MA 02116

RE: MetroWest Growth Management Committee Recommendations for the MBTA Worcester Commuter Rail Extension Project.

Dear Mr. Haley,

The MetroWest Growth Management Committee, a voluntary alliance of the Towns of Ashland, Framingham, Natick, Southborough, Sudbury, Wayland, Wellesley, Weston, the City of Marlborough and the Metropolitan Area Planning Council, was formed in 1985 to foster informed and active cooperation in planning for the growth and development of the region. The MetroWest Transportation Task Force, a broad-based task group of local elected officials, planners, businessmen and regional transportation officials, assists the Committee by addressing regional transportation issues with the goal of providing a safe and efficient mix of transportation alternatives in the region and reducing traffic. The Transportation Task Force discussed outstanding local and regional issues related to the MBTA Commuter Rail Extension to Worcester during its last two meetings.

The April 14, 1992 meeting had local representation from Ashland, Framingham, Grafton, Hopkinton, Marlborough, Natick, Sudbury, Southborough, Wayland, Westborough, Weston and Worcester, and regional representation from Central Massachusetts Regional Planning Council (CMRPC), Metropolitan Area Planning Council (MAPC), Massachusetts Bay Transportation Authority (MBTA), Massachusetts Highway Department Districts 3 and 4, and the Massachusetts Turnpike Authority. Discussion centered around local and regional issues related to existing and future service areas, station location, economic development, reverse commute and assessment procedures.

The May 5, 1992 meeting was a working session of Task Force members to discuss the issues presented at the previous meeting and to assess how these issues relate to the local and regional transportation network and to the MetroWest Traffic Policies, adopted in 1988.

Based on these discussions, the MetroWest Transportation Task Force submitted recommendations to the MetroWest Growth Management Committee for consideration and action at the May 13, 1992 meeting. After a presentation and update from Mr. Lawrence Parretti, the MetroWest Growth Management Committee discussed outstanding issues and voted unanimously to offer the following recommendations to the MBTA:

1. In addition to efforts already being pursued, the MBTA should aggressively pursue location of a station adjacent to intersections of commuter rail, Route 495 and the Mass Turnpike, and/or the City of Marlborough.

MetroWest encourages the development and maintenance of public transit to serve the region, and is supportive of the MBTA Worcester Commuter Rail Extension Project in principle. The Committee feels that a connection to the existing interstate highway system would be particularly efficient, given that the MetroWest region appears to lack sufficient north/south primary roads, and the use of I-495 and I-90 could collect a substantial number of commuters from the north, west and south without causing additional strain to the already congested network of highways and local roads.

2. The MBTA should ensure that all adverse impacts resulting from commuter rail extension to Worcester be mitigated, be they on the new or the existing portion of the rail line.

Although the MetroWest Traffic Policies encourage development and maintenance of public transit, the provision of new services (i.e. Commuter Rail Extension to Worcester) can be expected to attract additional traffic in the vicinity of new as well as existing stations. The MetroWest Growth Management Committee stresses that consideration should be given to assess and mitigate any negative impacts caused by an increased frequency of trains in any community or by additional traffic near stations. This includes at-grade intersections wherever they exist, such as those at Route 126 and Dennison Crossing in Framingham. Studies should be done not only for new station locations, but wherever significant impacts are likely to occur.

3. The policy of the MetroWest Growth Management Committee shall be to support an MBTA assessment formula that reflects access to services and actual usage, and not the historical accidents or legislation that have resulted in inequitable assessments.

The MetroWest Growth Management Committee feels that the MBTA Assessment procedure should be more equitable. The Committee

encourages the MBTA to explore the feasibility and equity of expanding assessment formula to incorporate quotas established to reflect the proportion of real usage, rather than the existence of transit within particular communities.

MetroWest appreciates the opportunity to comment on the MBTA Worcester Commuter Rail Expansion Project, and looks forward to continuing participation in the planning process involving the region's transportation alternatives.

Sincerely,

Iryna Priester /AC

Iryna Priester
Chairman

IP/AC/ac

cc: Richard Taylor, Secretary of Transportation
MetroWest Growth Management Committee
MetroWest Transportation Task Force
Local MBTA Committees
MHD, District 3
MHD, District 4
MAPC
CMRPC
Legislators
Rocco Mancini, MBTA
Lawrence N. Parretti, Jr., MBTA

MetroWest
Growth Management Committee
13 East Central Street
Natick, MA 01760
508•651•7350

RECEIVED
SEP 29 1992
MEPA

September 24, 1992

Honorable Susan Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Attention: MEPA Unit
Re: Worcester Commuter Rail Extension Project, EOEA #9154

Dear Secretary Tierney,

The MetroWest Growth Management Committee, a voluntary alliance of the Towns of Ashland, Framingham, Natick, Southborough, Sudbury, Wayland, Wellesley, Weston, the City of Marlborough and the Metropolitan Area Planning Council, regularly reviews development proposals deemed to have regional impacts. The review process was created by unanimous agreement of members in order to better understand and mitigate the negative impacts of development in the region. The Committee's review is advisory in nature.

MetroWest applauds the Mass Bay Transportation Authority's endeavor to provide public information in this project, and the involved communities' thorough and enthusiastic participation. As a result, most of the towns along the extension and the City of Worcester have formed local advisory committees to examine this project. The extent of local involvement was evident in the meticulous and comprehensive comments regarding the significance of the potential environmental impacts of this project offered by the communities at MEPA's September 15, 1992 informational meeting.

The Committee, through its Regional Impact Review Process has reviewed the Worcester Commuter Rail Extension Project, EOEA #9154 and offers the following comments regarding the proposed project's regional impacts:

A. ENVIRONMENTAL IMPACT REPORT
MetroWest believes that it is essential that the full design and

impacts of the proposed Worcester Commuter Rail Extension Project be studied in an Environmental Impact Report (EIR) in order to continue the public process that has been initiated and to provide sufficient local and regional public comment and input.

B. MAJOR AND COMPLICATED PROCESS
Given the magnitude of the Worcester Commuter Rail Extension Project, its geographic and chronologic stretch, the multiplicity of its potential impacts and the crucial need for collective input and consensus, the Committee requests that this project be designated as Major and Complicated. This process would allow for the formation of a joint review committee, with local and regional representatives, to guide, tailor and streamline the review process.

C. PROCESS AND TIMING FOR STUDY OF A REGIONAL STATION AT I-495
The Committee formally requested that the Mass Bay Transportation Authority aggressively pursue location of a regional station adjacent to the intersection of the commuter rail, I-495 and the Massachusetts Turnpike (Please refer to the enclosed letter to Mr. John Haley Jr., May 26, 1992.) The Committee believes that locating a multi-modal station in the vicinity of I-495 could enhance the attractiveness of commuter rail to potential users, thus getting additional automobiles off the roads. In addition, a station at Route 495 could also substantially reduce the number of commuters that would use local roads to get to the Southborough and Westborough stations, an important issue for residents in these communities.

The ENF states that the feasibility of locating a regional station at the intersection of I-495 and the Massachusetts Turnpike was evaluated and remains a long term goal of MBTA. The MetroWest Growth Management Committee requests that the <u>process and timing</u> for studying that option be detailed in the EIR.

D. PROJECT STUDY AREA
The ENF was limited to the study of the five intermediate stations. The Committee acknowledges that the feasibility of a future terminus at Worcester Union Station is currently under study, and does not wish to unduly delay MBTA's process. The Committee is amenable to the study of a definitive terminus station at this location in a separate ENF.

However, MetroWest feels that the ENF's fragmentation of the project is not necessary or appropriate, that segmentation of

impacts that should be considered as cumulative should not be permitted and that the EIR should include, in addition to the five intermediate stations:

1. The Framingham Station, including any new improvements, new parking facility, and impacts to the already critical operation of the Route 126 grade crossing, but excluding platform lengthening and traffic signal modifications scheduled to begin this year, and which must proceed as soon as possible and independently from the Extension project.

2. The temporary Worcester terminus station at the existing Amtrak station, including any modifications to tracks, platforms or parking, as well as impacts to the site and its surrounding area.

3. A layover facility in the vicinity of the Worcester Terminus, and its related impacts.

E. ACCESS THROUGH LOCAL ROADS

MetroWest's Transportation Policies for the region, endorsed by all the member communities, are based on maintaining acceptable levels of service along its major numbered highways and on the use of these highways as the principal travel routes so that local roads are not overburdened with commuter and commercial traffic.

The Committee shares the concern of several of the communities along the service area in that access to some of the stations would impact residential areas and already congested local streets. MetroWest requests that MEPA require that the MBTA examine alternatives in the EIR to minimize intrusion in residential neighborhoods and local roads.

Furthermore, a complete list of affected roads is not listed in the ENF. While the ENF proposes several on-site mitigation measures, it fails to address off-site mitigation of local roads. MetroWest requests that the proponent be required to provide accurate information in the EIR regarding existing and projected traffic volumes on all the roads serving each of the sites according to MEPA guidelines, and that all impacts be mitigated. The Committee strongly advocates for a full range of transportation alternatives, including car-pooling and van pooling, bike paths and other options to be implemented in

conjunction with commuter rail service to minimize dependence on single-occupancy automobile use.
Thank you for the opportunity to comment on the Worcester Commuter Rail Extension Project ENF. Please include MetroWest in the list of interested parties to whom additional information is sent.

Sincerely,

Iryna Priester ac

Iryna Priester
Chairman
IP/AC/mjf

Enclosures

cc: MetroWest Growth Management Committee
MetroWest Transportation Task Force
Lawrence N. Parretti, Jr., MBTA
Mary Hynes, Marlborough Chamber of Commerce
Honorable Michael P. Hogan, Marlborough
David Parry, Marlborough City Planner
David Kutner, Framingham Planning Board Administrator
Arthur Noonan, Framingham Planning Director
Steve Kerlin, Ashland Town Planner
Dex Malone, Ashland MBTA Committee
Kathleen Bartolini, Southborough MBTA Committee
Wayne Thies, Southborough Town Planner
Elaine Toplyn, Hopkinton Town Planner
Peter Lowitt, Grafton Town Planner
Lee Bourgoin, Westboro MBTA Committee
Stephen Bishop, Millbury Town Planner
Ed Bates, MAPC
Carl Hellstrom, CMRPC
Julie Jacobson, Worcester OCPD
Cindy Duncan, MetroWest Chamber of Commerce TMA
Bob Sloane, EOTC
Peter Donahue, MHD District 3
MetroWest Legislators

central massachusetts regional planning commission

•340 Main Street Suite 747
•Worcester, MA 01608
•Phone (508) 756-7717

September 4, 1992

Mr. Jeffery Dore
1484 Grafton Road
E. Millbury, MA 01527-4335

Dear Mr. Dore:

As per your request, I have completed a Level of Service Analysis for the intersection of Route 122 with the Massachusetts Turnpike Ramps and the proposed access road for the Millbury Commuter Rail Station. Based upon the results of this analysis, it appears that while the addition of the commuter rail traffic will result in an increase in delay at the intersection, it will not cause a reduction in the existing Level of Service at this location. The following presents a more detailed description of my findings.

Existing Conditions

A 24 hour traffic count was performed by CMRPC in September 1991 on Route 122 in the vicinity of the Massachusetts Turnpike Ramps. This count recorded a total daily volume of 25,268 vehicles along this segment of the roadway. This number is almost 10,000 vehicles higher than the daily volume of 15,743 which is presented in the ENF for the project. As a result of this discrepancy, the higher traffic volumes were used in the analysis.

A turning movement count was conducted by CMRPC in September, 1991 at the intersection of Route 122 with the Massachusetts Turnpike Ramps as part of the Highway Performance Monitoring System (HPMS) project. In addition, the Massachusetts Highway Department has developed traffic volume adjustment factors based upon data collected from permanent count stations. Based upon this data, it has been determined that the month of September is approximately seven percent higher than average monthly conditions. However, in order to conduct a more conservative study the traffic volumes were left unadjusted for this particular analysis.

Background Traffic

Traffic volumes throughout an area will tend to increase over time as a result of normal growth or due to specific developments which affect the area. An estimate of the background traffic growth should be considered in order to estimate the roadway traffic volumes which will exist when the development is completed (assumed to be 1995). Again data from the Massachusetts Highway Department was consulted in order to select a

background growth rate for the area. Based upon this information, a growth rate of 2.5% per year was selected and applied to the 1991 traffic volumes.

Site Generated Traffic

In order to forecast the expected traffic volumes from the Millbury Commuter Rail Station, the Environmental Notification Form (ENF) filed by the Massachusetts Bay Transportation Authority (MBTA) for the project was consulted. In the ENF, it was estimated that a total of 944 new daily trips would be added to the area as a result of the Millbury Station. These 944 trips were evenly divided into 472 morning trips, and 472 evening trips. Next, a proposed schedule for the Worcester Commuter Rail as shown in the Commuter Rail Extension Feasibility Study by Stone & Webster, Inc. was consulted in order to determine the most likely time periods at which people would arrive at the station. Based upon this schedule, and again in order to conduct a more conservative study, it was estimated that 70% of all evening trips would result from the 4:10 PM and 4:40 PM trains out of Boston. It was further estimated that 90% of all trips would be exiting from the site during the evening peak hour while 10% of all traffic would enter the site. Traffic distribution of the commuter rail traffic was based upon existing traffic patterns. The 1995 evening peak hour traffic volumes are attached to this document.

Capacity Analysis

The intersection was analyzed using the techniques documented in the 1985 Highway Capacity Manual which calculates volume to capacity ratios, average delay, and level of service for the intersection. Two different scenarios were analyzed for the intersection. The first scenario assumed that no new improvements would be added to the intersection other than the construction of the access road and traffic control signal improvements. Scenario 2 assumed that several geometric improvements were also made at the intersection including the installation of an exclusive left turn lane on the southbound approach of Route 122, and an exclusive right turn lane on the access roadway. The results of this analysis are shown in Table 1.

Table 1
Level of Service Analysis

	Existing		Build	
	LOS	Delay	LOS	Delay
Rte 122/I-90/Access Road	D	29.08	D	38.16
Intersection w geometric improve.			D	26.84

As can be seen from the results of the analysis, the construction of the commuter rail station is expected to increase the delay by nearly ten seconds at the intersection of Route 122 with the I-90 ramps during the evening peak hour. However, this will not result in a decrease in Level of Service (LOS) at this location. The construction of exclusive turn

lanes at this intersection would reduce the overall delay to 26 seconds, but the LOS is expected to remain at "D". A copy of the results of the capacity analysis are attached to this document.

Conclusions

Based upon the results of the capacity analysis, it does not appear that the construction of the Millbury Commuter Rail Station will severely impact the intersection of Route 122 with the I-90 ramps. However, in order to increase safety and further reduce the impact of the commuter rail station on existing traffic using Route 122 it is recommended that an exclusive left turn lane be constructed on the southbound approach of Route 122. It is also recommended that an exclusive right turn lane be added to the access roadway out of the commuter rail station, and a through movement lane be constructed on the I-90 approach to the intersection. If you should have any questions or require additional information, please do not hesitate to call.

Sincerely Yours,

Gary M. Roux

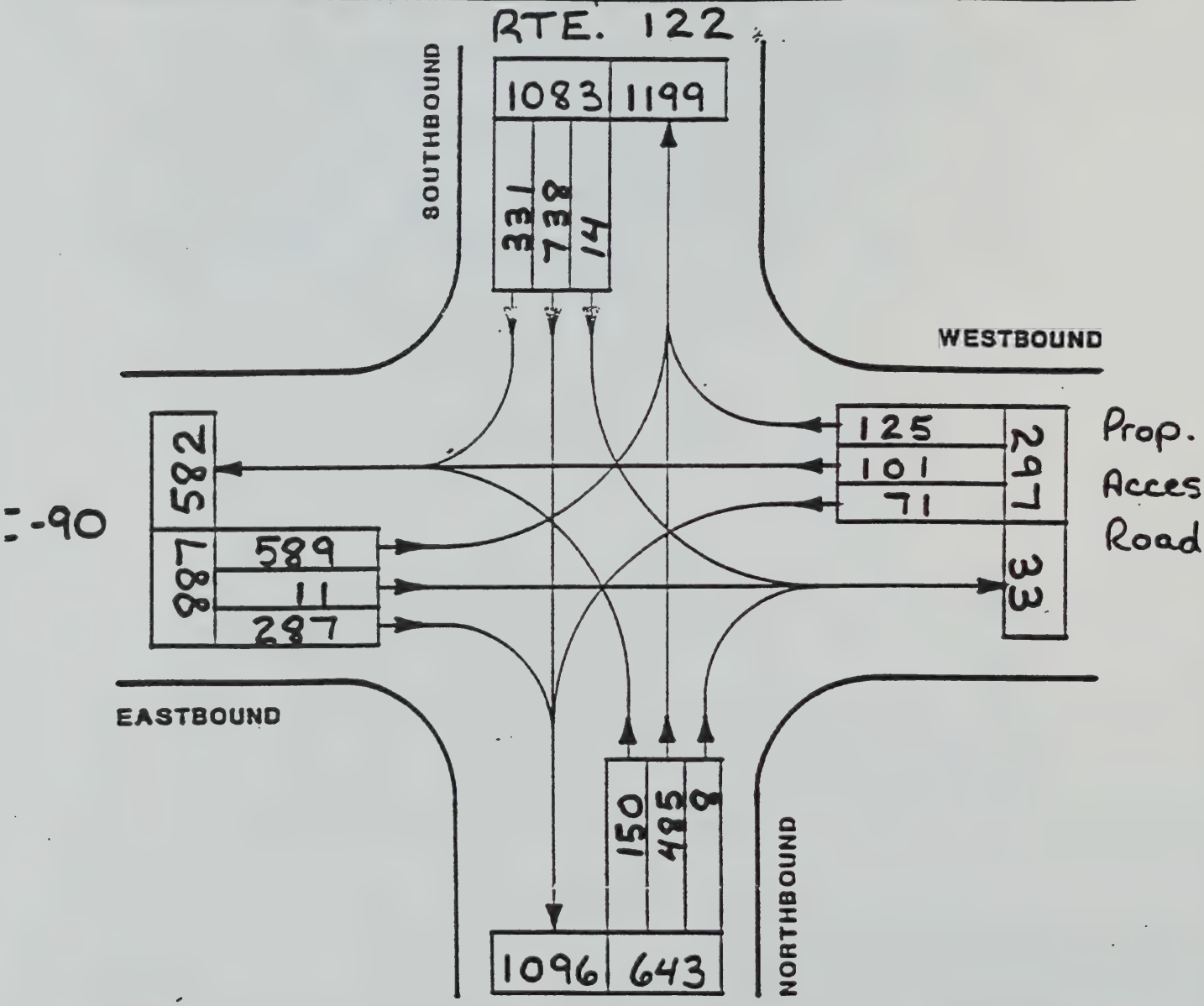
Gary M. Roux
Associate Transportation Planner

CMRPC

INTERSECTION TURNING MOVEMENT COUNT

CITY Millbury DATE _____ DAY of WEEK _____

INTERSECTION RTE 122 / I-90 / Prop. Access Rd. JOB No. _____



STREET	ENTERING VOLUME	PERCENT OF FLOW	TIME of COUNT
			1995 PM BUILD
			VEHICLES COUNTED
			ALL VEHICLES XXX
			TRUCKS (XX)
TOTAL			PERCENT TRUCKS %

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
RTE 122/I-90 RAMPS/ACCESS ROAD
1995 BUILD PM PEAK HOUR
date:09-03-1992 time:11:24:01
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=122B1M GEOMETRICS=12290A SIGNAL=12290A
LOCATED IN CBD:N

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	589	11	287	0	1	1	0.0	12.0	12.0	40
WB	71	101	125	0	1	0	0.0	12.0	0.0	45
NB	150	485	8	1	1	0	12.0	12.0	0.0	45
SB	14	738	331	0	1	1	0.0	12.0	12.0	45

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK				PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	6.6%	N	0	0	.980	0	N	18.3	3
WB	0.0%	0.0%	N	0	0	.900	0	N	18.3	3
NB	0.0%	1.4%	N	0	0	.980	0	N	18.3	3
SB	0.0%	4.4%	N	0	0	.980	0	N	18.3	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1									*	*	*		*	*	*		31.0	5	A
2	*	*	*														11.0	0	A
3	*	*	*		*	*	*										18.0	5	A

CYCLE= 70.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	589	11	287	.980	601	11	293
WB	71	101	125	.900	79	112	139
NB	150	485	8	.980	153	495	8
SB	14	738	331	.980	14	753	338

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH	612	1	1.00	612	0.98	0.00
EB	RT	293	1	1.00	293	0.00	1.00
WB	LT-TH-RT	330	1	1.00	330	0.24	0.42
NB	LT	153	1	1.00	153	1.00	0.00
NB	TH-RT	503	1	1.00	503	0.00	0.02
SB	LT-TH	767	1	1.00	767	0.02	0.00
SB	RT	338	1	1.00	338	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	79	112	139	100	100	100	0	1	0	251
WESTBOUND	601	11	293	0	62	0	0	1	1	7
NORTHBOUND	14	753	338	100	100	0	0	1	1	753
SOUTHBOUND	153	495	8	100	100	100	1	1	0	503

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s

WB	LT-TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.543	1.000	[illegible]
NB	LT	1800	1	1.000	0.993	1.000	1.000	1.000	1.000	1.000	0.153	273
NB	TH-RT	1800	1	1.000	0.993	1.000	1.000	1.000	1.000	0.998	1.000	1783
SB	LT-TH	1800	1	1.000	0.978	1.000	1.000	1.000	1.000	1.000	1.000	1761
SB	RT	1800	1	1.000	0.978	1.000	1.000	1.000	1.000	0.850	1.000	1497

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
WB	70	18	1	330	251	79	0.24	1	7	0.00
NB	70	31	1	153	503	153	1.00	1	753	0.02
SB	70	31	1	767	1091	14	0.02	1	503	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
WB	1800	0.004	17.798	0.871	0.239	0.202	0.761	0.173	1.292	1.000	1.000
NB	1767	0.426	2.031	0.404	1.000	28.969	0.000	0.000	2.782	0.153	0.153
SB	1800	0.279	15.873	0.561	0.019	15.127	0.981	13.969	2.007	1.000	1.000

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	612	1346	0.45	0.41	558	1.10	*
EB	RT	293	1481	0.20	0.41	614	0.48	
WB	LT-TH-RT	330	1518	0.22	0.26	390	0.85	
NB	LT	153	273	0.56	0.44	121	1.27	*
NB	TH-RT	503	1783	0.28	0.44	790	0.64	
SB	LT-TH	767	1761	0.44	0.44	780	0.98	
SB	RT	338	1497	0.23	0.44	663	0.51	

CYCLE= 70.0 LOST=10.0 SUM V/S CRIT= 1.02 TOTAL V/C= 1.19

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	1.10	0.41	70.0	16.73	558	62.53	0.85	67.38	F	14.9	
EB	RT	0.48	0.41	70.0	11.37	614	0.46	0.85	10.06	B	3.3	
WB	LT-TH-RT	0.85	0.26	70.0	18.76	390	10.82	0.85	25.14	D	4.8	
NB	LT	1.27	0.44	70.0	18.82	121	210.16	0.85	194.63	F	9.1	
NB	TH-RT	0.64	0.44	70.0	11.50	790	1.22	0.85	10.81	B	5.4	
SB	LT-TH	0.98	0.44	70.0	14.63	780	21.23	0.85	30.48	D	10.7	
SB	RT	0.51	0.44	70.0	10.66	663	0.56	0.85	9.54	B	3.7	

DIR	Delay	LOS
EB	48.83	E
WB	25.14	D
NB	53.69	E
SB	24.08	C

INTERSECTION DELAY = 38.16 INTERSECTION LOS=D

THE CYCLE LENGTH WITHIN THE BOUNDS OF 70 TO 70 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 70.0 SECONDS

THE V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
for chosen cycle length 70.0
suggested timing phase 1 is 33.1 secs green, 5.0 secs yellow + red clear
suggested timing phase 2 is 7.0 secs green, 0.0 secs yellow + red clear
suggested timing phase 3 is 19.8 secs green, 5.0 secs yellow + red clear

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
RTE 122/I-290 RAMPS/ACCESS ROAD W GEOMETRIC CHANGES
1995 BUILD PM PEAK HOUR
date:09-03-1992 time:11:40:31
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=122B1M GEOMETRICS=12290AM SIGNAL=12290AM
LOCATED IN CBD:N
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	589	11	287	0	1	1	0.0	12.0	12.0	40
WB	71	101	125	0	1	1	0.0	12.0	12.0	45
NB	150	485	8	1	1	0	12.0	12.0	0.0	45
SB	14	738	331	1	1	1	12.0	12.0	12.0	45

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK				PEDESTRIANS			ARR
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NB	0.0%	1.4%	N	0	0	.980	0	N	18.3	3
SB	0.0%	4.4%	N	0	0	.980	0	N	18.3	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1									*	*	*		*	*	*		32.0	5	A
2	*	*	*														12.0	0	A
3	*	*	*		*	*	*										16.0	5	A

CYCLE= 70.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

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EB	LT-TH	612	1	1.00	612	0.98	0.00
EB	RT	293	1	1.00	293	0.00	1.00
WB	LT-TH	191	1	1.00	191	0.41	0.00
WB	RT	139	1	1.00	139	0.00	1.00
NB	LT	153	1	1.00	153	1.00	0.00
NB	TH-RT	503	1	1.00	503	0.00	0.02
SB	LT	14	1	1.00	14	1.00	0.00
SB	TH	753	1	1.00	753	0.00	0.00
SB	RT	338	1	1.00	338	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	79	112	139	100	100	0	0	1	1	112
WESTBOUND	601	11	293	0	57	0	0	1	1	6
NORTHBOUND	14	753	338	100	100	0	1	1	1	753
SOUTHBOUND	153	495	8	100	100	100	1	1	0	503

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EB	RT	1800	1	1.000	0.968	1.000	1.000	1.000	1.000	0.850	1.000	1481
WB	LT-TH	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1800
WB	RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.850	1.000	1530
NB	LT	1800	1	1.000	0.993	1.000	1.000	1.000	1.000	1.000	0.177	317
NB	TH-RT	1800	1	1.000	0.993	1.000	1.000	1.000	1.000	0.998	1.000	1783
SB	LT	1800	1	1.000	0.978	1.000	1.000	1.000	1.000	1.000	0.394	694
SB	TH	1800	1	1.000	0.978	1.000	1.000	1.000	1.000	1.000	1.000	1761
SB	RT	1800	1	1.000	0.978	1.000	1.000	1.000	1.000	0.850	1.000	1497

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
WB	70	16	1	191	251	79	0.41	1	6	0.00
NB	70	32	1	153	503	153	1.00	1	753	0.00
SB	70	32	1	14	1091	14	1.00	1	503	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
WB	1800	0.004	15.807	0.871	0.413	0.193	0.587	0.143	1.292	1.000	1.000
NB	1800	0.418	4.667	0.404	1.000	27.333	0.000	0.000	2.782	0.177	0.177
SB	1800	0.279	17.260	0.561	1.000	14.740	0.000	0.000	2.007	0.394	0.394

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	612	1433	0.43	0.40	573	1.07	*
EB	RT	293	1481	0.20	0.40	592	0.49	
WB	LT-TH	191	1800	0.11	0.23	411	0.46	
WB	RT	139	1530	0.09	0.23	350	0.40	
NB	LT	153	317	0.48	0.46	145	1.06	*
NB	TH-RT	503	1783	0.28	0.46	815	0.62	
SB	LT	14	694	0.02	0.46	317	0.05	
SB	TH	753	1761	0.43	0.46	805	0.94	
SB	RT	338	1497	0.23	0.46	684	0.49	

CYCLE= 70.0 LOST=10.0 SUM V/S CRIT= 0.91 TOTAL V/C= 1.06

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	1.07	0.40	70.0	16.72	573	50.21	0.85	56.89	E	13.2	
EB	RT	0.49	0.40	70.0	11.94	592	0.55	0.85	10.61	B	3.4	
WB	LT-TH	0.46	0.23	70.0	17.71	411	0.62	0.85	15.58	C	2.9	
WB	RT	0.40	0.23	70.0	17.41	350	0.41	0.85	15.14	C	2.1	
NB	LT	1.06	0.46	70.0	15.15	145	77.46	0.85	78.72	F	4.2	
NB	TH-RT	0.62	0.46	70.0	10.92	815	1.02	0.85	10.15	B	5.3	
SB	LT	0.05	0.46	70.0	8.00	317	0.00	0.85	6.80	B	0.2	
SB	TH	0.94	0.46	70.0	13.69	805	13.05	0.85	22.73	C	8.7	
SB	RT	0.49	0.46	70.0	10.12	684	0.47	0.85	9.01	B	3.6	

DIR	Delay	LOS
EB	41.32	E
WB	15.40	C
NB	26.15	D
SB	18.33	C

INTERSECTION DELAY = 26.84 INTERSECTION LOS=D

THE CYCLE LENGTH WITHIN THE BOUNDS OF 70 TO 70 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 70.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 237.7 SECONDS
for chosen cycle length 70.0
suggested timing phase 1 is 31.8 secs green, 5.0 secs yellow + red clear
suggested timing phase 2 is 10.8 secs green, 0.0 secs yellow + red clear
suggested timing phase 3 is 17.6 secs green, 5.0 secs yellow + red clear

central massachusetts regional planning commission

•340 Main Street Suite 747
•Worcester, MA 01608
•Phone (508) 756-7717

JD

RECEIVED
SEP 11 1992
MEPA

September 8, 1992

Ms. Susan Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02116

Attention: MEPA Unit - Jolene Dubner

Ref. - EOEA #9154

Dear Secretary Tierney:

Upon review of the ENF for EOEA #9145, the Worcester Commuter Rail Extension Project, it was discovered that the daily traffic volume reported for Route 122 in the vicinity of the proposed Millbury station is substantially different than the volume recorded in a count conducted by CMRPC in September, 1991 on Route 122 at the Worcester City Line. The CMRPC count recorded a total daily volume of 25,268 vehicles along this segment of the roadway. This number is almost 10,000 vehicles higher than the daily volume of 15,743 which is presented in the ENF for the project.

The Town of Millbury, concerned about the proposed location of the Millbury Commuter Rail Station, requested CMRPC staff to perform a Level of Service Analysis at the intersection of Route 122 with the Massachusetts Turnpike Ramps and the proposed commuter rail access road. The higher traffic volumes from the count conducted by CMRPC were used in this analysis. Based upon somewhat conservative assumptions, the construction of the commuter rail station is expected to increase the delay by nearly ten seconds at the intersection during the evening peak hour. However, no change in Level of Service (LOS) is anticipated. The construction of exclusive turn lanes at this intersection would reduce/negate the delay caused by rail station traffic, but the LOS is expected to remain at "D". A copy of the correspondence with the Town of Millbury has been attached to this document.

If you should have any questions or require additional information, please do not hesitate to call.

Very truly yours,

Gary M. Roux

Gary M. Roux
Associate Transportation Planner

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection
Metro Boston/Northeast Regional Office

William F. Weld
Governor
Daniel S. Greenbaum
Commissioner

JD

RECEIVED
SEP 22 1992
MEPA

September 18, 1992

Susan Tierney, Secretary
Executive Office of
Environmental Affairs
100 Cambridge Street
Boston, MA 02202

RE: Worcester Commuter Rail
ENF/EOEA #9154

Dear Secretary Tierney:

The Department of Environmental Protection Northeast Regional Office has reviewed the ENF submitted on behalf of the Massachusetts Bay Transportation Authority to extend commuter rail service from Worcester to Framingham (EOEA #9154). Of the seven municipalities that will be impacted by the project, Ashland and Framingham are within the boundaries of the DEP Northeast Regional Office.

As noted in the ENF, the proposed extension will involve the construction of five intermediate train stations and laying eleven miles of second track between and Westborough and Worcester. The entire 23 miles of right-of-way will be fenced with a 6-foot chain link fence. A section of the extension will transverse the Westboro Cedar Swamp, a designated Area of Critical Environmental Concern (ACEC).

The project will alter approximately 0.9 acres (39204 sq. ft.) of bordering vegetated wetlands. The ENF does not specify how much wetlands alteration will occur in each of the seven municipalities that will be impacted by the project. However, the ENF does note that the construction of the Grafton train station will alter over 5000 sq ft of bordering vegetated wetlands and therefore require a Variance of the Wetlands Protection Act Regulations (310 CMR 10.00). The project proponent is advised that under a proposed revision to the Wetlands Regulations, unless a project qualifies as one of the "limited projects" specified in 310 CMR 10.53, any alteration of bordering vegetated wetlands that occurs within an ACEC, even less than 5,000 sq. ft., cannot be permitted by a conservation commission. Therefore any work within the Cedar Swamp ACEC, such as the erecting a fence along the right-of-way, that involves alteration of bordering vegetation wetlands, will also

require a Variance of the Wetlands Regulations.

Since the project will at least require a Variance for work proposed in Grafton, the DEP recommends an EIR be required for this project. As part of the EIR, the project proponent should present an alternative analysis for siting the proposed intermediate train station in Grafton. The EIR should identify the specific resource areas, referenced in CMR 10.54 to 10.57, within each of the seven cities/towns to be impacted by the project. Evaluation of resource impacts should include the development of a map, at an appropriate scale, which identifies the square footage and/or linear footage of impacts to each wetland resource area. Also, the project proponent should address the three issues/criteria the Wetlands Regulations require the Commissioner to consider in reviewing a Variance request. Specifically, 310 CMR 10.58 specifies the Commissioner may waive the regulations when he finds:

"(1) there are no reasonable conditions or alternatives that would allow the project to proceed in compliance with the regulation(s);

(2) that mitigating measures are proposed that will allow the project to be conditioned so as to contribute to the protection of the interests identified in the Act; and

(3) that the variance is necessary to accommodate an overriding community regional, state or national public interest; or that it is necessary to avoid an Order that so restricts the use of property as to constitute an unconstitutional taking without compensation."

In documenting overriding public interest, the Applicant must show that the project is being pursued under the auspices of a public authority or a private entity found to be serving a public function. This should not be difficult for this particular project. In addition, the project proponent should show the overriding public interest associated with the project outweighs the detriments of lost wetland resource functions.

The applicant also should be required to identify and discuss all reasonable alternatives which have been considered to avoid wetland impacts. The Applicant should be required to state why those alternatives, which meet performance standards, have been found to be unreasonable or why the alternatives which do not meet performance standards are less desirable for wetlands protection than the proposed alternative.

Finally, the Applicant should be required to provide a full description of the mitigation measures which are proposed for this project. The discussion of mitigation measures should detail the extent of wetlands resource impacts, the functions associated with those resources, and the mitigation measures which will minimize resource impacts and/or restore resource functions. In discussing

replication of resource areas, the applicant should document how the replication effort will comply with the provisions of 310 CMR 10.55(4)(b). As part of this documentation, the EIR should also include detailed discussions as to the location, size, and methodology to be used in replicating resource areas as part of the mitigation plan.

The applicant should be advised that if the above information is not thoroughly presented as part of the EIR process, the request for this information will be required as part of the variance review process by the Department. Since the issuance of variance decisions has, in the past, taken considerable time, it is critical that the applicant consider the standards for a variance and address informational requirements during the project planning process. The incorporation of the above information in the EIR process will save the Applicant considerable time and may save the cost of the variance filing fee ($4000.00) if a variance does not appear likely following the full assessment of the project as part of the EIR.

The DEP Northeast Regional Office appreciates the opportunity to comment on this proposed project. If you have any questions regarding these comments, please contact me at (617) 935-2160.

Sincerely,

John Felix

John Felix,
MEPA Review Coordinator

cc: William Krol, DEP/DWW NERO
Michael Stroman, DEP/DWW Boston
Mary Richards, DEP/Admin. CERO

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection
Central Regional Office

William F. Weld
Governor
Daniel S. Greenbaum
Commissioner

RECEIVED
OCT 1 1992
MEPA

MEMORANDUM

TO: MEPA Unit
THRU: Philip Nadeau, Section Chief, Div. of Wetlands
FROM: Marielle Stone, Environmental Analyst, Div. of Wetlands
DATE: September 28, 1992
RE: Worcester Commuter Rail Extension Project
EOEA # 9154
ENF-Comments

The ENF indicates that approximately .9 acres (39,204 square feet) of wetlands resources will be altered by this project. The Department recommends that an EIR be prepared to explore and discuss alternative site locations and designs that will reduce the amount of wetland alterations. This information will be necessary to justify the need for any variance from the Wetlands Protection Act. Furthermore, the information will be necessary for a Water Quality Certificate applied for after October 1, 1992.

It appears that the majority of the wetland impacts will be due to parking lots. Have the use of multilevel parking facilities been considered to reduce the amount of area needed for parking? Are there any potentially feasible alternate locations for parking facilities or for the station that would result in less impacts, especially for the proposed Grafton station?

Detailed plans depicting the wetland resource areas to be effected by this project should be provided. The types and amount of wetland resource area impacts should be clearly identified. The potential impacts to the interests of the Wetlands Protection Act should be determined. These plans should be a scale of 1"=50' or better. The plans should depict the existing conditions and the proposed conditions of the station sites. Details of any wetland replication areas should be provided.

At the proposed Millbury station, two potential access roads are shown. An assessment of the wetland impacts should be provided for each of these alternatives.

75 Grove Street • Worcester, Massachusetts 01605 • FAX (508) 792-7621 • Telephone (508) 792-7650

Drainage calculations for pre and post development of the station sites should be provided for the 10 and 100 year storm events.

Are there any additional wetland impacts that may occur due to expansions or improvements to roadways leading to the proposed station locations?

cc: Jane A. Chmielinski, MBTA
Grafton Conservation Commission
Millbury Conservation Commission
Southboro Conservation Commission
Westboro Conservation Commission

MB 1A
~~9415~~ ~~JB~~ MAC
9154 NB

MASSACHUSETTS ★ HISTORICAL ★ COMMISSION ★
★ A CommonWealth to Keep ★

RECEIVED
SEP 8 1992
MEPA

July 24, 1992

Maryann T. Magner
Environmental Planner
Edwards and Kelcey, Inc.
529 Main Street
Boston, MA 02129

RE: Worcester Commuter Rail Extension Project, Framingham, Ashland, Southborough, Westborough, Grafton, Millbury, and Worcester, MA

Dear Ms. Magner:

Thank you for submitting an inquiry to the Massachusetts Historical Commission to assist in preparing the Environmental Notification Form for the proposed project referenced above, received July 10, 1992.

Preliminary review of the Inventory of Historic and Archaeological Assets of the Commonwealth indicates that the project area includes several properties that are listed on the State and National Registers of Historic Places, including the Concord Square Historic District, Framingham Railroad Station and Sudbury Aqueduct, Framingham, the Cedar Swamp Archaeological District, Westborough, Grafton State Hospital, Grafton, and multiple properties in Worcester, including Union Station. In addition, there are numerous properties along the project route that are included in the Inventory that are eligible for listing on the National Register. Finally, there are multiple historically and architecturally significant properties in the project area that have not yet been formally identified, inventoried and evaluated for National Register eligibility.

The project area extends through a diversity of environmental settings considered likely to contain significant archaeological deposits. While the entire impact area has not been systematically examined by archaeologists, several archaeological sites have been recorded within or adjacent to the project area. In New England, archaeological sites are usually buried in the soil and thus require systematic test excavations to be identified.

MHC recommends that a cultural resources survey be conducted in compliance with Section 106 of the National Historic Preservation Act of 1966 (36 CFR 800), Massachusetts General Laws, Chapter 9, Sections 26-27C, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71) and MEPA. The purpose of the survey is to locate and identify historically significant resources that may be affected by the proposed project. The reconnaissance survey should also identify specific areas of the project that are sensitive for containing archaeological resources. Once identified, archaeologically sensitive areas will require systematic subsurface (intensive-level) archaeological testing to locate buried archaeological deposits. The MHC is willing to assist the project proponent in developing an appropriate scope for the historic and archaeological survey. The archaeological survey must be conducted under permit (950 CMR 70) by the State Archaeologist.

If you have any questions, please feel free to contact Maureen A. Cavanaugh, Director of Architectural Review or Edward L. Bell, Staff Archaeologist of my staff.

Sincerely,

Judith B. McDonough

Judith B. McDonough
Executive Director
State Historic Preservation Officer

xc: Jane Chmielinski, Massachusetts Bay Transportation Authority
Local Historical Commissions

NB

RECEIVED
SEP 8 1992
MEPA

September 2, 1992

Susan F. Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

Attn: Nancy Baker and Jollene Dubner, MEPA Unit

Re: Worcester Commuter Rail Extension Project, EOEA No. 9154

Dear Secretary Tierney:

The staff of the Massachusetts Historical Commission has reviewed the Environmental Notification Form for the project referenced above, received August 24, 1992. The MHC has also had the opportunity to meet with representatives of the Massachusetts Bay Transportation Authority to review the proposed project and what effects the undertaking may have on significant cultural resources.

The rail line is within and adjacent to areas that contain properties that are listed on the National Register of Historic Places. These properties include the Framingham Railroad Station, Concord Square Historic District, and Sudbury Aqueduct, Framingham, the Cedar Swamp Archaeological District, Westborough, Grafton State Hospital and multiple properties in Worcester, including Union Station. In addition, there are numerous properties along the project route that are included in the Inventory that are eligible for listing on the National Register. Finally, there are multiple historically and architecturally significant properties that have not yet been formally identified, inventoried and evaluated for National Register eligibility.

The project area extends through diverse environmental settings considered likely to contain significant archaeological deposits. While the entire impact area has not been systematically examined by archaeologists, several archaeological sites have been recorded within or adjacent to the project area. In New England, archaeological sites area usually buried in the soil and thus require systematic test excavations to be indentified.

The MHC has requested that the MBTA undertake a reconnaissance cultural resources survey for the proposed project, to identify historically significant properties that may be affected by the undertaking. I have included a copy of MHC's letter of July 24, 1992 to Edwards & Kelcey, Inc., which details MHC's comments for your reference. The MHC looks forward to assisting the MBTA in developing an appropriate scope for the historic and archaeological survey.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act (36 CFR 800), M.G.L. Ch. 9, ss. 26-27C (950 CMR 71) and MEPA.

If you have any questions, please contact Maureen A. Cavanaugh, Director of Architectural Review or Edward L. Bell, Archaeologist, of this office.

Sincerely,

Judith B. McDonough

Judith B. McDonough
Executive Director
State Historic Preservation Officer

cc: Massachusetts Bay Transportation Authority
U.S. Army Corps of Engineers
Environmental Protection Agency
Department of Environmental Protection
Massachusetts Highway Department
Local Historical Commissions
Edwards & Kelcey, Inc.

Enclosure

JD

MASSACHUSETTS ★ HISTORICAL ★ COMMISSION ★ A CommonWealth to Keep

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OCT 1 1992
MEPA

September 25, 1992

Susan F. Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

Attn: Jollene Dubner and Nancy Baker, MEPA Unit

Re: Worcester Commuter Rail Extension Project, EOEA No. 9154

Dear Secretary Tierney:

The staff of the Massachusetts Historical Commission had the opportunity to attend the MEPA consultation meeting in Westborough on September 15, 1992, regarding the project referenced above. The MHC has previously commented on the Environmental Notification Form for the project in our letter to MEPA dated September 2, 1992. The following comments are in response to the information conveyed at the meeting, and should be appended to MHC's previous comments.

At the consultation meeting, the segmentation of the Union Station portion of the project from the MBTA Commuter Rail project was discussed. It was noted that MEPA regulations discourage the segmentation of projects. The MHC agrees that the commuter rail extension project, in its entirety from Framingham to Union Station in Worcester should be subject to public review, and recommends that the scope of the Environmental Impact Report include Union Station.

The monumental Union Railroad station, constructed between 1909 and 1911, was modeled after a Roman basilica and is listed on the State and National Registers of Historic Places. The MHC is very concerned about the disposition of this historically and architecturally significant landmark, which has suffered severely from deferred maintenance since its closing in 1972. The MHC encourages MEPA to consider Union Station as part of the Worcester Commuter Rail Extension project, to assure that thorough analysis of alternatives that would preserve the station for reuse is considered as a component of the project as a whole.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act, as amended (36 CFR 800) and M.G.L. Ch. 9, ss. 26-27C, as amended (950 CMR 71).

If you have any questions, please contact Allen Johnson, Preservation Planner or Edward Bell, Archaeologist of this office.

Sincerely,

Judith B. McDonough

Judith B. McDonough
Executive Director
State Historic Preservation Officer

cc: Massachusetts Bay Transportation Authority
U.S Army Corps of Engineers
Environmental Protection Agency
Department of Environmental Protection
Massachusetts Highway Department
Worcester Historical Commission
Edwards & Kelcey, Inc.
Preservation Worcester

The Commonwealth of Massachusetts

Executive Office of Transportation and Construction

Department of Public Works

Ten Park Plaza, Boston, MA 02116-3973

WILLIAM F. WELD
GOVERNOR

ARGEO PAUL CELLUCCI
LIEUTENANT GOVERNOR

RICHARD L. TAYLOR
SECRETARY

JAMES J. KERASIOTES
COMMISSIONER

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SEP 30 1992
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September 25, 1992

Susan Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

RE: Statewide - Worcester County Commuter Rail Extension - ENF - (EOEA #9154)

ATTN: Janet McCabe, Assistant Secretary
MEPA Unit

Dear Secretary Tierney:

The Massachusetts Highway Department (MHD) has reviewed the Environmental Notification Form (ENF) for the proposed Worcester County Commuter Rail Extension project. The project entails the extension of MBTA commuter rail service from Framingham to Worcester. This project will utilize existing rights-of-way and involves the construction of new passenger stations in the towns of Ashland, Southborough, Westborough, Grafton, and Millbury. The redevelopment of the Union Station site in Worcester is not included in this ENF, and is expected to be the subject of a separate MEPA review in the future.

Collectively, the overall project is expected to generate 5,546 vehicle-trips per day and will require approximately 2,100 parking spaces. However, the traffic impacts of the project will be dispersed throughout the roadway network serving the five individual passenger station sites. Because a new site drive will be constructed at the Route 122/Massachusetts Turnpike Exit #11 access road intersection, the proposed station site in Millbury will be the only component of the project that will require a MHD access permit.

The Massachusetts Department of Public Works
is now
The Massachusetts Highway Department

To achieve adequate vertical and horizontal clearance, the project also entails the reconstruction of the River Street bridge in Grafton and the Cordaville Road bridge in Ashland. The MHD District 3 and District 4 offices should be consulted for any additional permits that may be necessary for the reconstruction of these bridges. The proponent should also be aware that the MHD and the Town of Westborough are currently discussing the abandonment and demolition of the Fisher Street bridge in the vicinity of the proposed passenger station on Smith Valve Parkway.

Because the traffic impacts of the project are not expected to be concentrated at any particular station site, the MHD recommends that no further MEPA review be required for this project based on traffic issues. The resolution of any outstanding issues can be handled during the MHD permit process for the project.

If you have any questions regarding these comments, please contact Douglas Landry or me at 973-8137.

Sincerely,

William T. Steffens, Director
Highway and Capital Planning

cc: P. Moynihan, Deputy Commissioner
M. Swanson, Chief Engineer
S. Eidelman, Highway Engineering
C. Sterling, Traffic Operations
P. Donohue, DHE - District 3
L. Bedingfield, DHE - District 4
P. Anderson, Deputy Secretary, EOTC
R. Sloane, Assistant Secretary, EOTC

JD

The Commonwealth of Massachusetts

HOUSE OF REPRESENTATIVES
STATE HOUSE, BOSTON 02133

PAUL KOLLIOS
REPRESENTATIVE
7TH WORCESTER DISTRICT
AUBURN-MILLBURY-OXFORD

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SEP 28 1992
MEPA

Chairman, Committee on
Human Services and Elderly Affairs

ROOM 22, STATE HOUSE
TEL. 722-2291

September 25, 1992

Executive Office of Environmental Affairs
MEPA Unit
100 Cambridge Street, 20th Floor
Boston, MA 02202

SUBJECT: Worcester Commuter Rail Project

To Whom It May Concern,

I am writing in regards to the proposed commuter rail station site in the Town of Millbury.

I urge you to strongly consider the proposal by the Millbury MBTA Advisory Committee and Millbury Board of Selectmen to construct an access road off of Route 20. The MBTA should conduct a full study of this proposal.

The residents of Grafton Road in Millbury have experienced severely increased traffic conjestion for years. This proposal would greatly assist in mitigating this burdensome problem for this neighborhood area.

I would respectfully request you give this proposal your utmost consideration. If you have any questions or need additional information, please feel free to contact my office.

Sincerely,

Paul Kollios

Paul Kollios
STATE REPRESENTATIVE

CC: Jeffrey Dore
Joseph Bianculli
Millbury Board of Selectmen
Rocco Mancini, MBTA

The Commonwealth of Massachusetts
HOUSE OF REPRESENTATIVES
STATE HOUSE, BOSTON 02133

BARBARA GARDNER
STATE REPRESENTATIVE
8TH MIDDLESEX DISTRICT
HOLLISTON-HOPKINTON-MEDWAY
SOUTHBOROUGH-UPTON
ROOM 473 G, STATE HOUSE
TEL 722-2070

DISTRICT OFFICE:
114 JENNINGS ROAD
HOLLISTON, MA 01746
TEL 429-7594
FAYRE STEPHENSON
JENNIFER KERRIGAN
LEGISLATIVE ASSISTANTS

RECEIVED
SEP 28 1992
MEPA

September 28, 1992

Susan F. Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

Dear Secretary Tierney,

I write to request that the MBTA be required to file an EIR and to follow the full MEPA review process as work on the Worcester Commuter Rail Extension Project proceeds. In addition, there are several concerns specific to the proposed railroad station on Southville Road in the Town of Southborough which must be addressed.

Foremost among the town's concerns is the impact the new railroad station will have on traffic patterns. Unlike the other towns under consideration for railroad stations, Southborough has not received basic ridership projections. Of particular concern is that the narrow abutting railroad bridge may not be adequate when traffic increases. Southborough residents are also concerned that the new railroad stations in Ashland and Westborough may also affect traffic patterns in Southborough. As the traffic impact is studied, the MBTA must take into consideration that Southborough has no sidewalks making pedestrian safety an issue. Residents have also asked that lighting and bicycle lockers be a part of the design plan for the proposed station. Southborough citizens have also suggested that additional parking in downtown Framingham be considered.

There are two environmental issues specific to the Southborough site. First, the proposed railroad station and parking lot are next to the Sudbury River. Second, the site is now used for recreation such as fishing. Particular attention must be given to maintenance and drainage runoff as parking lot construction is planned. Town officials are concerned about the affect of drainage on ground water as well as a possible adverse impact on the habitat around the river itself. The MBTA's ENF outlines plans for providing access to the river and town officials are concerned that pedestrian safety be the focus.

Finally, town officials have indicated that the economic impact on neighborhood businesses near the proposed railroad station should be a part of the project study. Changes in traffic patterns could help or hinder small businesses in the area and the economic effects should be known.

I support the Worcester Commuter Rail Extension Project and believe that, if the MBTA is required to file an EIR and to follow the full MEPA review process, the project can be a success. I will look forward to hearing of your favorable consideration of my request.

Sincerely,

Barbara Gardner

BARBARA GARDNER
State Representation

cc: John J. Haley, Jr.
General Manager, MBTA

JD

Sudbury Valley Trustees, Inc.

Protecting the natural resources of the Sudbury, Assabet and Concord River valleys

RECEIVED
SEP 30 1992
MEPA

September 28, 1992

Secretary Susan F. Tierney
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Attention: MEPA Unit

Re: Worcester Commuter Rail Extension Project (EOEA #9154)

Dear Secretary Tierney,

Sudbury Valley Trustees, Inc. (SVT), a non-profit conservation organization, wishes to respond to your request for public comment on the proposal to extend commuter rail service westward to the city of Worcester from its current terminus in the town of Framingham. SVT has been involved in protecting land and other environmental resources in the Sudbury River Valley since 1953. We believe that while the proposed project has the potential for slightly alleviating traffic and air quality problems in downtown Boston, there could be secondary effects that would seriously degrade environmental quality in the rail corridor towns. As a result of those and other concerns outlined below, SVT urges that you require the applicant to submit a full Environmental Impact Report (EIR) for the project.

Commuter Rail vs. Other Transportation Modes

In light of estimated project costs of $80 million, plus the substantial annual subsidy that will be needed to maintain the service, it seems prudent to examine express bus service as an alternate way to provide commuter transportation. Has the MBTA conducted a comprehensive study of train vs. bus transportation modes? A study should include such parameters as total startup costs, annual expenses, environmental impacts, total energy budget, rider preference (train vs. bus), and rider preference when tied to the cost of fares and tax subsidies. If the applicant has not completed such a study, the scope for the EIR should require one.

Regional and Municipal Planning

Neither the EIR nor media coverage has mentioned the underlying justification for the project. Does the project have the endorsement of the Metropolitan Area Planning Council, the Metrowest Growth Management Committee, or other regional planning agencies? It would seem that absent recommendations by the regional planning entities to proceed with the project, the MBTA's proposal is at best premature,

P.O. Box 7 • Wayland, Massachusetts 01778 • 508-443-6300
215 Boston Post Road • Sudbury, Massachusetts 01776

and at worst ill-conceived.

At the local level, the project will increase the demand for additional residential housing units in towns located within the ridershed. Many of those same towns are still trying to assimilate the rapid and unplanned growth that resulted from the real estate boom of the 1980s. Have those municipalities anticipated commuter rail service in their planning studies, growth projections, and local zoning bylaws? If they have not, we believe that it is the responsibility of the proponent, a regional transportation authority, to assist the municipalities in planning for the changes that the project will bring.

We also think that project design should include considerations for a comprehensive inter-modal system to encourage shuttle-bus, bicycle, and pedestrian access to the new stations. Two possible adverse impacts of the project are: 1) an increase in local traffic congestion, and 2) a shift in air pollution problems from Boston to the rail line communities where stations will be located. Provisions for non-automobile access to stations would help mitigate those impacts.

Possible Station at Route 495/Massachusetts Turnpike

At the public meeting held in Westborough on September 15 to discuss the project, the MBTA representative stated that the ENF contained no reference to a so-called "regional station" at Route 495 and/or the Massachusetts Turnpike because the time required to receive approvals from the Federal Highway Administration was extremely long, up to eight years. He also acknowledged the presence of the Cedar Swamp Area of Critical Environmental Concern where the two interstate highways intersect, and mentioned the extremely high cost of creating a new rail station that would involve a new interstate ramp network. Given the remote likelihood of there being a station at Route 495/Mass. Turnpike in the foreseeable future, we do not think that it is necessary to include consideration of that potential regional station in the scope of an EIR.

Mitigation for Loss of Open Space and Habitat

The proposed project would entail the loss of several acres of open space, including both forested and non-forested habitat types. The EIR should address those habitat losses and should propose offsetting mitigation measures. It probably would be best for the MBTA to determine appropriate and acceptable mitigation by working with each community where stations are proposed. However, among the mitigation options should be the replacement of lost open space with land in the immediate neighborhood, of at least equal size and habitat type, purchased by the MBTA and dedicated permanently to public use. In the case of the proposed Southborough station at Cordaville, mitigation options should include the creation of a naturalistic riverside park that could incorporate remnants of the historic mill complex.

Environmental Issues

SVT's interests focus on the Sudbury and Assabet River watersheds. Two of the proposed new stations, Southborough and Westborough, are located close to those rivers. The EIR needs to address roadway and parking lot runoff, both the quantities and the quality, so that discharges of increased or polluted runoff have no adverse impact on surface waters. That is particularly important for the Southborough station, which is next to a section of the Sudbury River that receives hatchery-raised trout stocked by the state Division of Fisheries and Wildlife.

We also question the need to construct chain link fences along the entire length of the rail corridor. A fence would almost certainly disrupt established wildlife travel routes. The rail line is a very active one now, carrying numerous freight trains and some Amtrak passenger trains daily. If the proposal to fence the corridor is justified at all, the EIR should explain why.

Thank you for the opportunity to comment on the commuter rail extension proposal. SVT will maintain an active involvement in the project as it continues.

Sincerely,

Stephen T. Johnson
Executive Director

cc: Boards of Selectmen, Conservation Commissions, and Planning Boards of:
Ashland, Grafton, Millbury, Southborough, and Westborough
Representative John Driscoll
Representative Barbara Gardner
Representative David Magnani
Senator Matthew Amorello
Central Massachusetts Regional Planning Commission
Metropolitan Regional Planning Council
MetroWest Growth Management Committee

JC

Boston Area Bicycle Coalition
P.O. Box 1015, Kendall Square Branch
Cambridge, Massachusetts 02142
(617) 491-RIDE

RECEIVED
SEP 30 1992
MEPA

September 27, 1992

Susan Tierney
Executive Office of Environmental Affairs
100 Cambridge St., 20th floor
Boston, MA 02202

Re: EOEA # 9154

Dear Secretary Tierney:

The Boston Area Bicycle Coalition (BABC) is the largest non-profit, bicycle advocacy organization in the Commonwealth. The BABC promotes the use of bicycles as transportation and advocates for improved bicycle facilities and better, safer access to public transportation facilities for intermodal connections. Thank you for the chance to comment on the proposed commuter rail extension to Worcester.

The ENF talks about the stations being "modern intermodal transportation facilities," yet does not mention what will be done to promote and accommodate bicycle access to the stations. These stations are locally oriented and should encourage kiss-and-ride patrons and bicycle commuters. The BABC recommends that the MBTA install its standard, high-quality bike rack, the Ribbon Rack, in secure locations, under cover, at these stations. We also recommend that the MBTA take the lead on installing some bike lockers at these stations. Lockers are the best security measure possible and installation of some at each station would send a strong message that the MBTA is serious about intermodalism.

The two proposed pedestrian overpasses at the Grafton station and at the Millbury station should be designed wide enough for a bicycle and a wheelchair to pass comfortably and safely. Access roads to the stations should have five-foot shoulders to accommodate bicycles and should have adequate sightlines for safety.

Although the Worcester terminus will be presented as a separate ENF, it should be noted that a major commuter bikeway, the Blackstone River Valley Bikeway, is proposed to terminate at the Union Station intermodal center. It is being planned by the MHD and DEM. Given this fact, it would be prudent to promote bicycle use to all of the proposed stations.

Sincerely,

Anne McKinnon

Anne McKinnon

JD

CITY OF WORCESTER, MASSACHUSETTS

WILLIAM J. MULFORD
City Manager

STEPHEN F. O'NEIL
Director

Telephone
799-1400

EXECUTIVE OFFICE OF THE CITY MANAGER
OFFICE OF PLANNING AND COMMUNITY DEVELOPMENT
455 MAIN STREET, ROOM 309
WORCESTER, MASSACHUSETTS 01608-1885

September 10, 1992

RECEIVED
SEP 14 19_
MEPA

Secretary Susan Tierney
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

RE: EOEA #9154
Worcester Commuter Rail Extension

Dear Secretary Tierney:

Worcester's Office of Planning and Community Development (OPCD) is pleased to observe progress toward completion of commuter rail service from the second largest city in New England to Boston. The extension of commuter rail to Worcester will result in profound economic development, transportation and environmental benefits for Worcester, the region and the Commonwealth of Massachusetts. In evaluating this ENF, OPCD personnel notes that the ENF incorrectly states that an EIR is not required. We question this ommission and wonder whether it is inadvertent or by design. We note that 301 CMR 11.25 (1), (2), (12), (17), (19), and (20) are thresholds which seem to indicate that this project is categorically included for the preparation of an EIR. This point needs classification.

Given the apparent project requirement for an EIR the following comments are provided.

1. The ENF indicates that the Worcester commuter rail stop at the Union Station site will be the subject of another ENF. OPCD recommends against this decision for the following reasons:

   a. EOEA has a policy against segmentation of projects requiring an EIR review. This policy is reasonable because segmentation usually confuses the review procedures and would result in long term project delays. Due to the importance of this project, segmentation could cause more harm than good for the City of Worcester.

b. Worcester is the only host community whose legislative body has officially selected a commuter rail site. (See attached Worcester City Council Resolution). Our success in forming a concensus for site selection should be rewarded. Worcester's efforts should not be jaded by delays in termainal site selection and indecision amongst host communities along the rail corridor. For Worcester and the total project itself, the inclusion and importance of a pre-selected Union Station site should not be overlooked, especially within the context of strengthening intermodal options within the region.

c. Currently the Union Station site is the subject of a comprehensive site development/feasibility study which is scheduled for completion in December 1992. We have our station site and soon we will confirm its shape and form. This on-going planning merely establishes that site development at Union Station is focused and is consistent with the goals and objectives of the Commuter Rail EIR.

d. The ENF proposes a layover facility at the Union Station site. The most efficient way to accommodate these layover facilities is to incorporate them now into the Union Station site development plans. This coordinated approach reinforces the advisability of including the area in any and all environmental analysis.

2. OPCD recommends that EOEA give consideration toward allowing work to proceed on the least controversial areas of the project (e.g. upgrade of rail lines in some areas) to allow some initial construction to begin in a timely manner.

3. The Metropolitan Planning Organization (MPO) for the Worcester area is the Central Massachusetts Regional Planning Commission (CMRPC). The CMRPC recognizes the importance of the project as a key element of the commuter rail extension and as such, included the Union Station Project on the Transportation Improvement Program (TIP) list this year. The TIP recommends funding in the amount of $10 million to be appropriated from ISTEA monies in fiscal years '93, '94, '95. Again, this action supports the need to target the Union Station area in the EIR

analysis now rather than later. Lastly, the MBTA submitted its TIP list which included a request for $10 million for the Union Station project. Should a new Union Station terminal still be under construction at the time that the commuter rail service is ready to begin, a temporary station can be set up on the site to support regular service as scheduled. Rail service at the Union Station site should be viewed as an opportunity, not an obstacle.

4. Resulting from the EIR, if any of the station stops from Millbury to Framingham are not developed immediately, construction focus should shift to Worcester. The Union Station terminus and areas adjacent to the site could support the additional parking space requirements necessary for expanded regional commuter rail service. Worcester, as the center of Central Massachusetts, must play a role in focusing rail service and fostering intermodal opportunities.

5. Given the size and scope of the project and noting the EIR categorical inclusions, the most significant issues to be addressed in the EIR should be traffic, economic development/joint development impacts, parking, wetlands, hazardous materials, regional impacts, historic resources and rail traffic planning.

In summary, OPCD recommends the addition of the Union Station site and associated development as part of this ENF and subsequent EIR. The construction of the layover facilities and the success of the commuter rail project to its terminus in Worcester is dependent upon avoiding EIR segmentation of key project components.

We look forward to working with state officials in bringing commuter rail service to Worcester. If you have any questions regarding these comments, please contact me at (508) 799-1400.

Sincerely,

Stephen F. O'Neil

Stephen F. O'Neil
Director

/cid
cc: William J. Mulford, City Manager
Michael S. Latka, Executive Director, WRA
Robert Ojala, WRTA

City of Worcester

Pursuant to a vote of the Committee on Commerce and Development, Be It

Ordered: That the City Council be and they are hereby requested to recommend the Union Station site as the preferred site for both the intermodal transportation center,(ITC), and commuter rail station of the Massachusetts Bay Transportation Authority, (MBTA).

In City Council
Order Adopted.

March 24, 1992

Robert J. O'Keefe, Clerk

A Copy. Attest:

City Clerk

CITY OF WORCESTER, MASSACHUSETTS

WILLIAM J. MULFORD
City Manager

STEPHEN F. O'NEIL
Director

Telephone
799-1400

EXECUTIVE OFFICE OF THE CITY MANAGER
OFFICE OF PLANNING AND COMMUNITY DEVELOPMENT
455 MAIN STREET, ROOM 309
WORCESTER, MASSACHUSETTS 01608-1885

RECEIVED
SEP 25 1992
MEPA

September 25, 1992

Secretary Susan Tierney
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

RE: EOEA #9154 Worcester Commuter Rail Extension

Dear Secretary Tierney:

On September 24, 1992 a meeting was held involving officials from Worcester's Office of Planning and Community Development (OPCD), EOTC, and the MBTA to discuss OPCD's comments on the ENF for the Worcester Commuter Rail Extension. Based on discussions at this meeting, the following comments are provided:

1. EOTC and MBTA officials reaffirmed their committment to a commuter rail stop in Downtown Worcester. The MBTA plans to implement commuter rail service to the existing Worcester Amtrak Station in 1994.

2. OPCD enthusiastically supports the MBTA's plans to establish commuter rail service to the Amtrak Station in a timely manner as a temporary measure until the development of a permanent Intermodel Transportation Center at Union Station is completed in accordance with the attached Worcester City Council resolution.

3. EOTC, MBTA, and OPCD are committed to working with EOEA in establishing procedures which will ensure the proper completion of project impact studies within the EIR process. In addition, we are committed to assisting an EIR procedure which involves phasing of project components to ensure completion of various components in a timely manner.

In summary, OPCD looks forward to the economic and environmental benefits of commuter rail service to Worcester and will continue to provide any assistance required in establishing this project.

Sincerely,

Stephen F. O'Neil

Stephen F. O'Neil
Director

/mbt
cc: Thorn Mead, EOTC
Rocco Mancini, MBTA

JD

WORCESTER PLANNING BOARD
WORCESTER, MASSACHUSETTS

RECEIVED
SEP 2 ? 1992
MEPA

September 14, 1992

Secretary Susan Tierney
Executive Office of Environmental
Affairs
100 Cambridge Street
Boston, MA 02202

Dear Secretary Tierney:

On behalf of the Worcester Planning Board, I want to express my strong support for the plans to bring commuter rail service to Worcester. Many of the detailed technical comments resulting from the Environmental Notification Form (ENF) will be generated by municipal staff and regional/state review agencies. However, from a planning policy perspective, rail service is extremely important for Worcester and the region.

Upon review of the ENF, please accept the following as policy considerations from the Worcester Planning Board:

Union Station

The Planning Board suggests that the Union Station site as the prime and only location of Worcester's commuter rail station. Although on-going structural analysis has yet to yield the actual fate of the aging structure, the Board suggests the inclusion of the site itself in the environmental analysis now. Once the decision on the structure is made in December, the MBTA should move quickly to include the City's preference in the environmental review.

Worcester and the Region

Worcester, as the center of the region, should be the focus of rail service and should not fall victim to local reluctance on station placement. If host communities along the rail line baulk at siting stations, then the emphasis must shift to Worcester. If the service is truly intermodal and regional then it should originate from the center of the region.

Millbury Station

The siting of a station in Millbury will have a profound impact on Worcester, specifically, Grafton Street (Rte. 122) and Rte 20. Is it necessary to site a station in an abutting community when the Worcester terminal is easily accessible? This question takes on greater importance as the host communities wrestle with the decision to place a terminal within their communities. Again, Worcester is the focus of the region and is in the best position to handle intermodal transportation needs and impacts. Care should be taken in placing an additional station close to the boundaries of the City.

These comments are general in nature, but must guide larger policy decisions that lead to the implementation of rail service to Worcester. The City's role in Central Massachusetts will be strengthened by this new service, but could be weakened if the service is diluted along the new rail line by insensitive station development.

The Worcester Planning Board looks forward to working with the MBTA on this project and we are confident that open and frank policy discussions will yield exciting results. The sight of commuter rail service within Washington Square in Worcester will have a dramatic effect on downtown, the City, the region and the Commonwealth.

Sincerely,

John T. Reynolds, Chairman
Worcester Planning Board

/lmb

Worcester
Regional
Authority

287 GROVE STREET
WORCESTER, MASSACHUSETTS 01605
(508) 791-2389 FAX (508) 752-1676

September 18, 1992

RECEIVED
SEP 2 ? 1992
MEPA

Ms. Susan Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Attn: MEPA Unit

Subject: EOEA File #9154
Worcester Commuter Rail Extension

Dear Secretary Tierney:

The Worcester Regional Transit Authority (WRTA) endorses the subject Environmental Notification Form submitted by the Massachusetts Bay Transportation Authority for the Worcester Commuter Rail Extension Project.

Kindly be advised that the WRTA will be submitting an Environmental Notification Form for an Intermodal Transportation Terminal, the terminus for the subject project at the present Union Station site, when the development plan for this terminal is completed in cooperation with the City of Worcester. We anticipate filing this ENF during the January to March, 1993 quarter.

Accordingly, this is to request a determination that will allow the MBTA to proceed with the Worcester Commuter Rail Extension Project in an expeditious and complete manner.

Please feel free to contact me if you have any questions or need further information.

Sincerely,

Robert E. Ojala
Administrator

Copies to: Robert D. Johnson
Steven O'Neil
Carl E. Hellstrom
Jane A. Chmielinski
Charles Stewart

Regional Environmental Council, Inc.
of Central Massachusetts
Box 255, Worcester, MA 01613

JD

September 28, 1992

RECEIVED
SEP 29 1992
MEPA

Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge St.
Boston, MA 02202

Attention: MEPA Unit

Re: EOEA #9154

To whom it may concern:

I am writing to offer comments on the ENF for the Worcester Commuter Rail Extension Project, EOEA #9154.

I am in complete support of re-establishing commuter rail service between Worcester and Boston. To promote the success of the venture, I would suggest that consideration be given to what incentives the MBTA can offer to both employers and employees to encourage them to use the service. I know that transit passes are available--can the price for a pass be adjusted to encourage their use?

To minimize air quality and development impacts, it also seems desirable to offer riders who carpool to the T stations a reduced rate for parking (if there is a parking fee) or a reduced fare.

The ENF states that the crew quarters/equipment shed at the layover facility will be heated electrically. Electric heat is the least efficient form of heating because it takes more fuel at the power plant to produce the electric heat than if the fuel were burned to produce the heat directly.

The ENF excludes the Worcester terminus from this phase of the review process. The redevelopment of the Union Station site will demand careful and thorough review, which should not be rushed. I would suggest that, given the uncertainty surrounding Union Station, the MBTA ought to develop some contingency plan for a temporary Worcester terminus. This will divorce the timetable for the redevelopment of the Union Station site from the timetable for the re-establishment of commuter rail, so that the best redevelopment decisions can be made, with no chance of delaying the rail project.

Sincerely,

Ted D. Conna

Ted D. Conna
President

cc: Diana Parcon, MBTA

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PRESERVATION WORCESTER

Sept. 11, 1992

RECEIVED
SEP 1 4 19
MEPA

Susan Tierney,
Secretary
Executive Office of Environmental Affairs
Att: MEPA Office
100 Cambridge Street
Boston, MA. 02202

RE: Worcester Commuter Rail Project

Dear Secretary Tierney:

Worcester's proposed intermodal project including commuter rail has been included on the TIP list of MBTA and CMRPC for potential funding under ISTEA. Therefore, it has been recognized an important regional project.

Thus, it should not have been excluded from the MEPA review process. Despite the fact that the status of the existing Union Station may take a while to be resolved, this need not hinder the commencement of commuter rail service at the site - in a manner similar to the existing Amtrak service - i.e. independent of the existing Union Station structure.

I assure you that Preservation Worcester supports restoration of commuter rail service from the Union Station area in an expeditiously manner. We cannot afford delay in the restitution of the commuter rail connection between Boston and Worcester.

Sincerely,

Jeanne Van Orman
Executive Director

71 Pleasant Street • Worcester, Massachusetts 01609 • (508) 754-8760

Worcester Area
Chamber of Commerce

JO

RECEIVED
SEP 30 1992
MEPA

September 28, 1992

The Honorable Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02222

RE: Worcester Commuter Rail Extension Project

Dear Secretary Tierney:

We are pleased to write to you regarding the Environmental Notification Form (ENF) for the Worcester Commuter Rail Extension Project which is now being considered by your office.

We have reviewed the ENF and sent a Chamber representative to the consultation meeting held on September 15th at the Forbes Community Building in Westboro.

The Worcester Area Chamber of Commerce is pleased to go on record in strong support of the Worcester Commuter Rail Extension project. We believe that this project will be of great benefit to the Central Massachusetts economy while helping to alleviate the traffic congestion which confronts many Worcester area travelers en route to the Boston area on a daily basis.

In our opinion, the Environmental Notification Form (ENF) submitted to your office satisfactorily addresses the areas of environmental concern and that a complete Environmental Impact Report (EIR) should not be required for this project.

We look forward to learning of your determination in late October.

Sincerely,

Bill Short

William J. Short
President

William E. Purcell
Vice President

Small Business

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Fax 508-754-8560

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SEP 9 1992
MEPA

September 8, 1992

Ms. Susan Tierney
Secretary of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Att. MEPA UNIT - Worcester Commuter Rail Project

Dear Madame Secretary:

The City of Worcester is extremely pleased at the prospect of commuter rail linking Worcester and Boston. It is a very significant element in our program of economic development and downtown revitalization.

A station in downtown at the Union Station site is essential to our comprehensive program. The rebuilt Galleria, Centrum, Convention Center, and Medical City complex are all easy walking distance to the Union Station site. It is expected that all those projects will be served by commuter rail.

Our goal of establishing downtown Worcester as the commercial, retail, educational, and cultural center of the region will be enhanced by a downtown station.

We are concerned that the ENF does not include Union Station. There are two important points to be made:

1. Union Station site is critical to Worcester's downtown plans

2. It is important that the project not be delayed. Interim plans can be made for a downtown Worcester site. An entire ENF should not be necessary for Union Station -only a study of that site.

Very Truly Yours,

Janet Slovin
Target Worcester

JS/jcc

ADDRESS P. O. Box 6357
JFK Post Office
Boston, MA
02114

ADDRESS 76 Bianca Road
Duxbury, MA
02332

ADDRESS 23 Stevens Road
Westborough, MA
01581

Brotherhood of Locomotive Engineers

DIVISION 57

March 1, 1992

Mr. Denzil C. Drewry, Chairman
Board of Selectmen
Town of Westborough
Town Hall - 34 West Main Street
Westborough, MA 01581-1998

Dear Chairman Drewry:

As a resident of Westborough, intimately familiar with the plans of the Massachusetts Bay Transportation Authority (MBTA) to extend Commuter Rail Service to Worcester, I would ask the Board to consider some recommendations in addition to those of the MBTA Advisory Committee.

I would preface my comments by stating that the following is not intended to conflict with the recommendations of the Advisory Committee. These are more technical in nature and therefore should not be expected to naturally flow from a committee made up primarily of residents unfamiliar with day to day railroad terminology and operations.

My support for these recommendations comes from 19 years as a locomotive engineer. I have worked in through freight, local freight, yard, intercity passenger and commuter passenger service since 1973. I was previously employed by the former Boston & Maine Railroad and moved to AMTRAK on January 1, 1987, when it assumed operation of the MBTA Commuter Rail Service. I currently operate commuter trains originating and terminating on the line between Boston and Framingham, in addition to other lines, and am qualified to operate in all areas which Commuter Rail serves.

Additionally, I am the labor representative for all engineers in this service and therefore have a vested interest in its success and the safety of the passengers and train crews.

Mr. Denzil C. Drewry, Chrmn.
Board of Selectmen

March 1, 1992

The first recommendation concerns train speed. As the Feasibility Study indicates, the maximum passenger train speed between Boston and Worcester, a distance of 44.3 miles, is 60 MPH. We recommend that the Board request that the MBTA give serious consideration to upgrading the line to permit 80 MPH service wherever possible.

Current train running time between Boston and Framingham is approximately 45 to 50 minutes (depending on time of day) making all station stops enroute. An express train stopping only at Back Bay, Boston can make the trip in 35 minutes.

The MBTA projects that morning and afternoon rush hour trains to Worcester will run express between Back Bay and Framingham and running time will be approximately 46 to 49 minutes to or from Westborough, utilizing current track speeds as a yardstick.

We believe that 80 MPH service will encourage even greater commuter use. In light of the Third Harbor Tunnel and Central Artery depression projects, this will help reduce highway traffic and carbon emissions (a necessity if the State is to comply with Federal Clean Air requirements).

The second recommendation concerns safety. We believe the MBTA should be encouraged to include Cab Signal and Speed Control systems as adjuncts to the track side signaling system when the system is redesigned for Commuter Service. These systems are already in place along the line starting at CP-33 (a location just East of Corrugated Paper switch) and continuing West beyond Worcester. Further, MBTA Control Coaches and locomotives are already equipped with the necessary on-board systems.

These two systems work in conjunction with each other and the track side signal system to alert the engineer to any changes in the condition of the track ahead which may affect the safe movement of the train.

Further, the system enforces any reduction in speed required by either track side or cab signal indication. The engineer must comply with the speed required by the signal or the system automatically applies the train brakes and interrupts power to the wheels until the train comes to a stop.

Absent such a system, the engineer is governed exclusively by the indications displayed on the wayside signals. He operates his train governed by the last indication observed on the wayside signals. If track conditions change within

Mr. Denzil C. Drewry, Chrmn.
Board of Selectmen

March 1, 1992

the block while the train is between signals, the engineer would probably not be aware of it.

Installation of these systems will increase the cost of the project. However, we believe they enhance the safety of the traveling public and are well worth the additional cost.

If it is not deemed feasible to increase current operating speeds, we still recommend installation of the Cab Signal/ Speed Control systems. They are safety features that have demonstrated their worth on both Conrail and AMTRAK lines.

The purpose of these suggestions is to encourage greater use of the Commuter Rail system and to enhance safety for both passengers and train crews.

As a resident, an experienced locomotive engineer and on behalf of the engineers who I represent, I am requesting the Board give these recommendations serious consideration and encourage the MBTA to implement them.

Yours truly,

Michael J. O'Bryan
Local Chairman
Division 57, BLE
23 Stevens Road
Westborough, MA

J. L. Mitton SECRETARY-TREASURER
ADDRESS P. O. Box 6357
JFK Post Office
Boston, MA
02114

M. J. Sullivan PRESIDENT
ADDRESS 76 Bianca Road
Duxbury, MA
02332

JD M. J. O'Bryan LOCAL CHAIRMAN
ADDRESS 23 Stevens Road
Westborough, MA
01581

Brotherhood of Locomotive Engineers

DIVISION 57

September 16, 1992

Ms. Susan F. Tierney, Secretary
Executive Office of Environmental Affairs
Commonwealth of Massachusetts
100 Cambridge Street
Boston, Ma 02202

RECEIVED
SEP 21 1992
MEPA

Attention: Nancy Baker/Jollene Dubner, MEPA Unit

Reference: File No. 9154

Dear Secretary Tierney:

The following comments reflect the concerns of the members of the Brotherhood of Locomotive Engineers (BLE) who operate Commuter Rail trains in the MBTA Commuter Rail Service.

First and foremost, we believe it to be the best interest of all concerned parties that an Environmental Impact Report be required and such Report should be designated as "Major and Complicated".

The BLE believes the Secretary should require the MBTA to resolve the following issues before signing off on the project:

1. Cross-track pedestrian access. It is imperative that cross-track boarding be prevented. An inter-track fence should be installed which prevents passengers from crossing over one track to get to a platform serving the other track. Such fence should be high enough to discourage anyone from climbing over it and should extend far enough beyond the limits of the platforms to discourage attempts to circle around the limits of the fence. Walkways over or under the tracks should be installed at both ends of each platform.

The installation of a gauntlet track within stations will effectively prevent the installation of an intertrack fence and encourage passengers to walk on the right of way to cross tracks. The only other alternative is to widen the right of way sufficiently to allow room for a gauntlet track and an operating track between a platform and a fence.

2. Signals. We recommend that both tracks be signaled for bi-directional running, combining fixed wayside signals with Cab Signal and Speed Control systems. These systems are already in service from CP-33 (approximately one mile east of the proposed Otis Street station in Westborough), west through Worcester. They provide a continuous in-cab signal indication of the condition of the track ahead to the engineer and electronically enforce speed limits mandated by signal indication.

Signals should be located so as to permit the engineer of an approaching train to view such a signal from at least one-half mile away. This is particularly important in the case of Interlocking and Control Point signals.

We recommend that a representative of the BLE be consulted with regard to signal design, type to be installed and location of signals.

We believe that 80 MPH service is feasible within the Boston to Worcester Corridor. We recognize that such speed cannot be sustained over the length of the entire corridor due to curves and other restrictions. However, where restrictions prevent 80 MPH service, the necessarily lower speeds can be enforced through timetable instructions to the engineers.

We would point out that the higher speed would provide a more attractive alternative to the highway mode and encourage even more commuters to utilize the service, thereby further reducing the load on the highway system and improving air quality.

As further support, we would point out that recently Federal money has been made available to study the feasibility of raising speed limits to 95 MPH in the Boston to Springfield intercity corridor, thereby opening the door for MBTA to raise its operating speeds to the limits of its equipment, currently 80 MPH.

Enclosed for your reference is a copy of a letter to the Westborough Board of Selectmen submitted on March 1, 1992,

Ms. Susan F. Tierney, Secretary
Executive Office of Environmental Affairs
File No. 9154

September 16, 1992

which outlines my background and expands on some of the subjects raised in this letter.

If there are any questions regarding the intent of my comments or questions regarding train operations in the MBTA Commuter Rail Service, please feel free to contact the undersigned at any time. As noted earlier, we believe the members of this labor organization can provide useful, intelligent input which will enhance the service.

Yours truly,

Michael J. O'Bryan
Local Chairman
Division 57, BLE

Enclosure

JD

Town of Ashland, Massachusetts

OFFICE OF

SELECTMEN & TOWN MANAGER

101 MAIN STREET, 01721

TERESA M. EVANS, *Chairman*
BARRY M. BRESNICK, *Vice-Chairman*
GARY A. GHILANI, *Clerk*
JOHN H. ELLSWORTH
LAWRENCE P. HUNT

RECEIVED
SEP 29 1992
MEPA

PAUL D. SHARON, *Town Manager*
Tel. (508) 881-0100
Fax. (508) 881-0102

September 25, 1992

Mr. John J. Haley, Jr., General Manager
Mass. Bay Transportation Authority
Transportation Building
Ten Park Plaza
Boston, MA 02116

RE: MBTA Worcester Commuter Rail Extension

Dear Mr. Haley:

The Board of Selectmen, at a regularly scheduled meeting of 24 September, voted unanimously to request that a thorough analysis of the environmental impacts be undertaken in connection with the proposed location of the Ashland station. Many of the issues have been incorporated in a more detailed comment letter submitted by Town Planner, Stephen J. Kerlin.

There is particular concern that the proposed station improvements be evaluated vis-vis the remediation measures undertaken by the U.S. Army Corps of Engineers, at the adjacent Nyanza Superfund site.

To this end, the Board is supporting and sanctioning this station siting on Pleasant Street in Ashland, reserving their rights, as previously communicated to you, to negotiate satisfactory results to a myriad of other concerns relative to lighting, screening, landscaping, platform architecture, off-site traffic impacts, maintenance, signage, and the like.

We look forward to working with you on this important project.

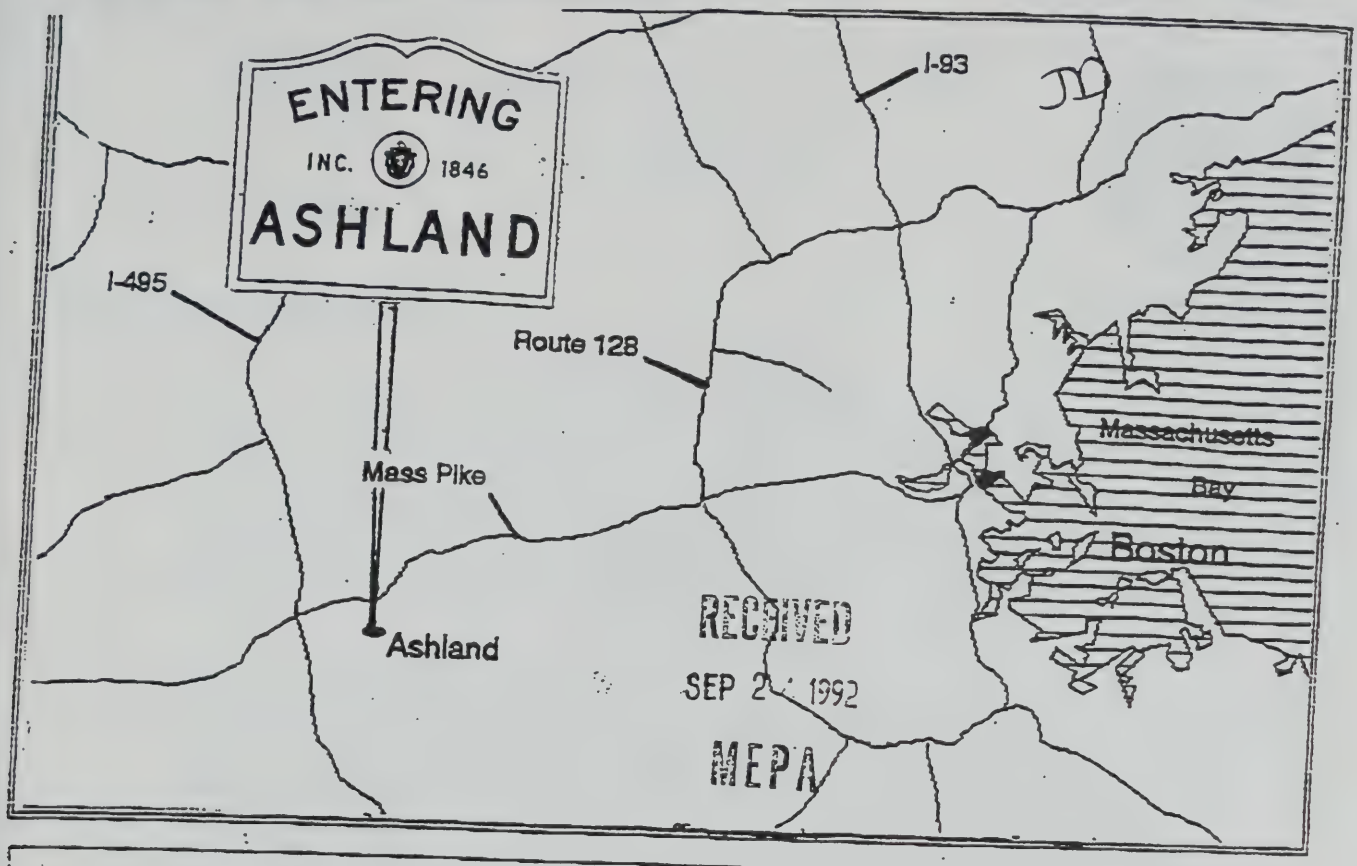
Yours very truly,

TOWN OF ASHLAND

Paul D. Sharon,
Town Manager

DPS/pd

cc: Board of Selectmen
Secretary Tierney, EOEA
MBTA Rail Committee
Representative Magnani



TOWN OF ASHLAND, MASSACHUSETTS

FAX TRANSMITTAL SHEET

Date: 9/23/92

From: Stephen Kerlin FAX (508) 881-0102

Number of pages (including this sheet): 10

To: NANCY Baker

Company: MEPA

Regarding:

Note: if any of these fax copies are illegible, or you do not receive the same number of pages as stated above, please contact us immediately at: (508) 881-0100 - Office of Board of Selectmen and Town Manager - Town of Ashland

<FAXSHEET.FRM>

ASHLAND PLANNING BOARD
TOWN HALL
101 Main Street
Ashland, Massachusetts 01721

STEPHEN J. KERLIN
Town Planner

Telephone (508) 881-0115
Fax (508) 881-0102

RECEIVED
SEP 2 - 1992
MEPA

September 23, 1992

Susan F. Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Attn: Nancy Baker and Jollene Dubner, MEPA Unit

Re: EOEA File #9154
Worcester Commuter Rail Extension Project

Dear Secretary Tierney:

I am enclosing the following comments regarding the ENF for EOEA #9154, Worcester Commuter Rail Extension Project.

Many of these comments have been already expressed at the MEPA Scoping Meeting that was held on September 15, 1992 in Westborough.

The ENF report is extremely limited in scope both in the project description and the attached materials. In addition, the Stone and Webster report entitled "Final Report-Commuter Rail Extension Feasibility Study: Framingham to Worcester, Milford & Marlborough" conflicts with the ENF documentation.

I have itemized out areas that need further research and examination that an Environmental Impact Report should encompass.

1) I B) Narrative Project Description

I am concerned with the 2010 projections listed on Table 5-5 in the Stone and Webster Report that cite a daily parking demand for 450 cars in Ashland compared to the ENF listed 400 parking spaces at the proposed Pleasant St. station in Ashland. On schematic plans which have been previously presented before other Town agencies, it appears that parking spaces have been scaled back from 430-440 spaces near the brick building addition. The concern here is what are the correct parking space numbers.

The relationship of ridership and parking spaces should be re-examined in light of the location of the nearby commuter rail stations particularly Framingham and Southborough. The brunt of the potential ridership from MetroWest communities including Marlborough could frequent any one of these facilities. Traffic volume along Oak Hill Road, Oak Street, Cordaville Rd., Southview Rd. in Ashland and Southborough needs to be investigated.

Also the "kiss and ride" passengers are not being properly evaluated in the total review of ridership and placement of passenger loading zones at each site.

In addition, there should be an examination of the intermodal traffic within this area particularly in light of the local bus system known as LIFT which runs out of the Framingham-Natick area. This system currently runs bus lines thru Ashland to Hopkinton and Milford via Routes 126 and 135.

Also, many residents have expressed the desire to bike over to the proposed station, therefore accommodations such be considered for the "bike and ride" passengers. Also this would refer as well to those who walk from the nearby residences and downtown areas along with potential linkage to walking trails along the Sudbury River System.

2) Track and Signal Improvements

Paragraph 1

Ashland as well as the other communities opposes a 6 foot high chainlink fences along the rail line since it will act in a negative capacity to Downtown Ashland and the surroundings not only on aesthetics but a safety issue as well. If fencing is required some form of natural evergreen barrier or wooden fence would be preferred alternative. If the chain link fence is still a necessity then perhaps the evergreen barrier could be implemented as shield for aesthetic purposes. Finally, though should be given to emergency gates that were designed with releases to help remove stray animals or individuals that were in the railroad right of way.

Next, there are two grade crossings in Ashland within a one half mile of this proposed station. There should be some examination to design either below grade or above grade crossings at these points. To make this grade transition, will impact upon both the downtown and the immediate area of the proposed station in a dramatic fashion. Thought should be given to design a station with this concept in mind without disrupting the fabric of the community.

Paragraph 3

There is a concern with the design speeds of the trains with these new improvements. Currently there are noise level problems and safety concerns with existing passenger and freight trains running thru the community. With the probability of additional freight train service there will be a need for a sophisticated signal system to prevent accidents. Also design speeds of 80-100 mph need further review particularly in light of traversing downtown Ashland. Finally, noise abatement considerations must be taken to correct this situation particularly if older F'40 trains with 86 dcb are allowed for usage.

Station Locations/Layover Facility

Paragraph 5

Reference is made to each station having 300 spaces with a capacity of 400 spaces. Ashland is very concerned with possible expansion at the Pleasant St. site primarily due to its location for additional ridership in the event that the Southborough Station does at Rte 85 does not come on line.

Paragraph Six

Reference is made to landscaping and parking lots. Here detailed a site plan should be presented to the each community such as Ashland for review. In the case of the Pleasant St. station, there is a definitive opportunity to establish a facility that will be a trendsetter for upgrading the community. If not done properly it can only worsen the image of the incompatibility of the mixed land uses in the area.

Paragraph 7

Placing a regional station on line at I-495 and I-90 will have a direct bearing on the future of the proposed station in Ashland. The importance of placing that station on line quickly can not be overemphasized. The longer this station takes to come on line and whether it is every built could have tremendous negative impacts on both the Ashland and Southborough Stations.

E. Areas of Potential Impact

There are definite impacts by commuter rail on open space and recreation particularly in Ashland where major efforts have recently been made to activate a greenbelt system along the Sudbury River with walks and hiking trails. Perhaps linkage can be made between the recreational opportunities and rail link.

Next, extensive monies are being expended to upgrade the quality of the Sudbury River which includes wildlife and fishery habitat. Surface drainage and groundwater impacts should be evaluated and properly mitigated .

Also, the location of the proposed station to Nyanza should be examined to tie in long term improvement to this area. Perhaps some form of funding to create a pleasing environment in this area thru landscaping and buffering screens.

With regards to the category entitled "Community/Housing and the Built Environment, one can only reiterate that the proposed station could act as catalyst from improving the existing neighborhood. This includes streetscape improvements along with on lot landscaping and land use improvements. If this does not happen the neighborhood could further deteriorate.

II Project Description

D. Traffic Plan

The station plan submitted for Ashland depicts a paved area and parking lot that literally surrounds the Latter Rain Church building this leaves future usage of this building in question. Perhaps a better approach is placing the loading platform further west this locus closer to the buildings at 360 Pleasant to take advantage of the physical connection of the existing offices and restaurant use nearby. This would also improve the negative impact of close proximity to residences along Pleasant St.

At the same time consideration should be made to considering examining constructing the platform on both sides of the track with a pedestrian crossover. Plus examining better methods for pedestrian movement to reach the platform such as examining new technology such as "moving walks". This latter idea would be particularly advantageous to the elderly and others would live in the downtown area.

In addition, the installation of a second platform on the southerly side of the tracks would lend itself to additional parking along Magunko Road. There are a number of vacant parcels that could be used for parking as well. If proper improvements such as lighting and sidewalks are designed in the proposal, this would further serve to help mitigate the visual appearance and stigma of the Superfund site nearby.

The station plan also depicts parking for 400 spaces, this may lead to an overcrowding of parking spaces with little room for landscaped buffer areas such as trees, plants. Currently with a large open curb cut, a site plan depicting circulation is paramount. The drawing roughly depicts one cut and it is difficult to ascertain whether this scheme as drawn would be a proper design.

Traffic improvements along Pleasant Street such as an acceleration/deceleration lane on the southbound side of the street could help to minimize traffic congestion during peak hours by preventing backups. This in conjunction with proper curb cuts would prevent the additional air pollution emanating from motor vehicles that are idling.

Next, street improvements and traffic analysis should be further examined and reviewed for possible incorporation into the design. One, roadway improvements should be investigated for the Cordaville Rd., High Street, and Pleasant St. intersection. Other intersections such as Pleasant and Main Street, Pleasant St. and Tilton Ave./Summer St. should also be investigated.

Streetscape improvements should be examined such as extending the sidewalk from its current location near Metcalf Ave. down to the High Street area. Also the roadway edge should be defined with curbing and a grass strip with plantings along with improving roadway drainage in this area.

Other station plans depict a cross over platform, the Ashland station does not. In light of prohibiting cross over traffic across the tracks, the plan should incorporate some form of connection. Also consideration should be given to a second platform off of the other railroad track.

Finally, the increased number of trains will have a impact on the downtown and area intersections. Study should be begin on below grade or above grade crossings and design schemes that would minimize disruption for this downtown area in both a physical setting and in quality of life issues.

III Assessment of Potential Adverse Environmental Impacts

B. Historic and Archaeological Resources

Although the proposed station is located in a mixed use area, there is an historic restaurant known as Burnham's which is the site of the original start of the Boston Marathon. Care should be taken in preserving these historical assets and tieing them in to commuter rail proposal and the proposed Pleasant St. station. Also a local bridge at High Street is also of historical significance and may be used in an overall future land use redevelopment package for this area.

D. Water Quality

1. Drainage improvements along this area of Pleasant St. are necessary. Most drainage is sheet runoff and should be directed into a catch basin system that would separate out pollutants.

5. The station site should include public restrooms that tie into the existing sewer system. Chemical toilets and septic systems are not the most advantageous ways to improve groundwater status or encourage ridership and usage of area commercial businesses.

7. The Sudbury River system is being examined for possible water supply usage particularly downstream and therefore care should be taken in upgrading the water quality status particularly in light of the superfund site cleanup.

8. There are two existing wells nearby which are currently inoperable one is nearby in back of the ballfield on High St. and the other is near the northern banking of Mill Pond. Both wells could come on line again in the future. The Mill Pond site is directly affected by the water quality in the Sudbury River. Once the pollutants are taken out, this well site may be advantageous to the water system.

Also note that in 1991, the Town of Ashland, passed a by-law for aquifer protection zones which includes the High Street well area and incorporates language with provides for additional environmental safeguards. Said site is in close proximity to the proposed station and abuts the railroad right of way.

E. Solid Waste and Hazardous Materials

The importance of the relationship between the Superfund site and the proposed train site can not be overlooked.

G. Noise

The increased number of trains along with the accelerating and decelerating of trains that not only stop at the proposed station but cross the two grade crossings in the downtown area need to examined for possible mitigation measures. Again the age of the equipment used for transporting the commuters will also have a bearing.

At the current time, there is significant concern with the existing practice of horn blowing of the existing Amtrack trains and other trains that travel through Ashland. This noise is excessive and has instigated a number of complaints particularly from residents of the downtown area including the elderly housing complexes. If additional trains are utilizing this track, these audible warning will become more frequent and more disruptive to the normal everyday activities within the Community.

I. Aesthetics

Station design is critical to this area. Superficial treatment such as canopies are not enough. This building if done properly will be trend setter for this area and will have a positive impact on aesthetic appearance issues. If not, the neighborhood will experience further deterioration and blight. Streetscape improvements, landscaping on site, lighting signage, and on and off site circulation patterns are critical. "Aesthetics will make or break this project."

Other comments include the need to classify this project as a "major complicated project" would be in the best interests of all the communities along the rail corridor. The failure to lock in all sites particularly the Westborough and Southborough sites will have a tremendous impact on the Pleasant Street station. The "major complicated project" review would be such a mechanism to review these alternative station planning siting issues along with the preservation of the Sudbury River.

Again, the interrelationship among the planned stations is critical and joint meeting with neighboring towns is critical. Also if there is a second station planned for a community such as Ashland, the siting of this second station is critical to the placement of the first station.

If the stations are permanent fixtures, then every effort should be made to design and situate the proposed station for the advantages of the individual communities with some form of compensation should be offered to the affecting communities resulting in the negative impacts.

Next, the issue of traffic in the area of the proposed station along with on and off site improvements such as sidewalks, landscaping, bike racks, lighting can not be underemphasized in terms of importance.

Finally, this review would not be complete if the issue of assessments was not fairly resolved with the Town of Ashland. The loss of the reimbursement would be a significant drain on our local governmental budget. Some form of negotiation between the Town, the MBTA, and the State is necessary to resolve this matter before the Town proceeds any further. Otherwise Ashland will be forced into procedures to block the development of a station site in Ashland.

Sincerely,

Stephen Kerlin (rp)

Stephen J. Kerlin, AICP

TOWN OF FRAMINGHAM, MASSACHUSETTS

PLANNING DEPARTMENT

Memorial Building, Room B2
Framingham, MA 01701

Main Office: 620-4852
Housing Rehab Office: 620-4855

ARTHUR T. NOONAN
Planning Director

RECEIVED
SEP 29 1992
MEPA

The Honorable Susan Tierney, Secretary
Executive Office of Environmental Affairs
MEPA Unit
100 Cambridge Street
Boston, MA 02202

Project Identification:
Project Name: Worcester Railroad Extension EOEA #9154
Project Proponent: MBTA
Location: Framingham to Worcester

Dear Secretary Tierney:

The Town of Framingham Planning Department has reviewed the Environmental Notification Form for the Worcester Commuter Rail Extension Project and wishes to offer the following comments.

Project Scope

The project as defined, excludes the Framingham Commuter Rail Station, which is the current terminus of the service. However, Sheet #1 indicates a project boundary which includes the Framingham Station and extends to the east.

The status of the plans for Framingham should be clarified. But, whether or not the station is to be specifically included as part of this project, it should be subject to an analysis based on the impacts of service to Worcester. In addition, any signalization improvements scheduled for the station area should include coordination with the Dennison Crossing.

Framingham Station Improvements

The Town of Framingham is concerned that the improvements which have been committed to by the MBTA for the Framingham Commuter Rail Station be re-affirmed as part of this review process. The designation of Framingham as a Key Station effectively ensures that handicapped accessibility will be part of the project planning. However, the Framingham station will be the recipient of increased commuter volume due to the half-hour headway available from the station; particularly attractive to commuters will be the express service to Boston. Consequently, the Town is concerned that this increased volume be addressed as part of this review process. The distribution of the volume should also be studied as a result of the increase in service.

Safety

The Town urges that the station design proposed for Framingham maximize safety. The prohibition of cross track boarding is one reasonable approach and may ensure safety at the station itself. However, there is a concern for safety on the streets adjacent to the station which needs to be addressed. The provision of a pedestrian crossing bridge should be considered to alleviate potential hazards. The proponent should be required to study existing traffic conditions in the vicinity of the station and fund appropriate mitigation measures as necessary.

Parking

The Town has attempted to establish a consistent parking policy for the Downtown area adjacent to the Commuter Rail station. The projected increase in volume is scheduled to be addressed by the creation of a new commuter parking lot. The Town feels that all parking in the Downtown should be under unified control. This would help to eliminate spillover of commuter parking onto adjacent streets. The MBTA should commit to Town control of all parking areas created in the vicinity of the Commuter Rail station.

Service Characteristics

The proponent has clearly based the expansion of this service on Boston bound commuters. Despite this obvious focus, the proponent should be required to consider ways in which the so-called "reverse commute" can be implemented. The development of an attractive rail service from Boston to Framingham and Worcester should be studied.

The travel mode to the Framingham station should also be the subject of study. The primary access by automobile is clearly the focus thus far. However , the MBTA should commit to long-term funding for bus access to the Framingham station as well. The allocation of funds for bus service will complement the rail link and also provide further emission reduction.

Thank you for providing us with the opportunity to comment on the ENF for the Worcester Rail Extension.

Please include the Framingham Planning Department on the list of interested parties to whom additional information is sent.

Very truly yours,

Arthur T. Noonan

Arthur T. Noonan
Planning Director

Grafton Conservation Commission

Grafton, Massachusetts

RECEIVED
SEP 1 1992
MEPA

August 31, 1992

Secretary of Environmental Affairs
100 Cambridge St.
Boston, MA 02202
Attn: MEPA Unit

Re: Worcester Commuter Rail Extension Project

Dear Sirs:

The Grafton Conservation Commission has received a copy of the ENF for the referenced project. The Commission wishes to be notified of any upcoming site visit or consultation session. Send any notification to:

Grafton Conservation Commission
30 Providence Rd.
Grafton, MA 01519

or call the Commission office at 508-839-6862.

Grafton Conservation Commission

David C. Robbins, Chair

JD

Grafton Conservation Commission

Grafton, Massachusetts

September 24, 1992

Susan Tierney, Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge St.
Boston, MA 02202

Attention: MEPA Unit

Re: MBTA Worcester Commuter Rail Extension, EOEA File No. 9154

Dear Secretary Tierney:

The Grafton Conservation Commission submits the following comments in response to the Environmental Notification Form (ENF) for the above-referenced project.

The Commission feels strongly that it is essential that an Environmental Impact Report (EIR) be prepared for this project. Thus, the Commission was pleased to hear at the meeting in Westboro on September 15 that the project proponent intends to prepare an EIR. The Commission urges you to require the preparation of an EIR, as it is clearly in the best interests of the project to do so.

Wetlands Alteration

The Commission is extremely concerned about the proposal to fill what is apparently greatly in excess of 5,000 square feet of wetland at the site proposed for the Grafton station. In keeping with a no-net-loss policy, the Commission stresses the need to avoid wetland alterations except when there truly exists no feasible alternative. The Commission believes that the EIR must thoroughly address the following issues:

- *All* possible alternative sites in the general vicinity *must* be identified and evaluated. Each alternative site should be evaluated in terms of its suitability for the purpose (e.g., access, availability of parking space, siting relative to the rail line) and in terms of the impacts on the natural environment (e.g., wetlands, wildlife habitat) of the development of the site. The Commission is aware of at least one specific site—the area west of Pine Street and north of Route 30—that has previously been identified as a potential site for the commuter rail station; this site appears to require much less wetland alteration, and should be one of the alternatives evaluated.
- The feasibility of replicating the full value of the wetland proposed to be altered must be carefully considered. Although wetland replication is easy to propose, and may appear to be relatively easy to accomplish, it often turns out to be a questionable proposition. Wetland replication is not always successful, and even when it appears to be successful, it is often difficult to know whether the full value of the lost wetland has really been preserved. The Commonwealth has already lost so much wetland to development that the risk of loss of the value of tens of thousands of square feet of wetland is not to be taken lightly. The EIR

should include a thorough evaluation of the value of the wetland proposed to be destroyed, and should include a thorough study of the area proposed for the replication and of the probability of success of the replication.

- If it is concluded that the best site for the station does, as is currently proposed, require extensive filling of wetland, the EIR must fully justify such a conclusion. It should credibly demonstrate that there truly exists no reasonable alternative to the loss of so much wetland.
- To the extent that the proposed station site design does require alteration of wetlands, the EIR should demonstrate that the wetland alteration has been kept to an absolute minimum, again in keeping with the no-net-loss policy. Alternative site designs should be considered, to show that the chosen design reduces wetland alteration to the minimum required.

The Commission cannot stress strongly enough the need to make every effort to avoid wetland alteration, and where it cannot be avoided, to minimize it and to mitigate the impacts of any alteration. The EIR must make a convincing case that these efforts have been made.

Local Wetlands Protection Bylaw

The project proponent should be aware of the fact that Grafton has a local wetlands protection bylaw. The Commission's processing of a project under the local bylaw is generally combined with the processing under the Massachusetts Wetlands Protection Act, so as not to waste time and paperwork. However, the local bylaw is somewhat stricter than the Act; in particular, the bylaw imposes a number of strict performance standards relating to storm drainage system design. To the extent that the EIR touches on regulatory requirements, it should take the local wetlands bylaw into account.

Loss of Trees

The Commission is also concerned about the potential loss of a substantial area of forest. By at least one estimate, over 300 trees may be sacrificed to this project. The EIR should identify all natural resources, not just wetlands, that will be lost or otherwise impacted by the project. The EIR should demonstrate that the project is designed in such a way as to minimize the loss of, or adverse impact on, all natural resources.

Aquifer Protection

Most of Grafton's public water supply is drawn from a single aquifer. A portion of that aquifer underlies the general area under consideration for the site for the commuter rail station. The EIR should identify the aquifer area, including in particular the portion that lies within Grafton's Water Supply Protection Zoning Overlay District. The EIR should evaluate the potential impacts of the project on Grafton's public water supply. It should also be noted that the aforementioned zoning district may impose some special requirements upon the design of the station.

Impact on Wildlife

Finally, the Commission is concerned about the impact on wildlife movement of the proposed continuous fence along the right of way. The right of way passes through a largely undeveloped area in Grafton, from the Westboro boundary west for a distance of nearly two miles. This area should be evaluated for its actual or potential use as a wildlife corridor, and the EIR should show that any proposed fence will not adversely affect wildlife movement.

Conclusion

The Commission wishes to emphasize the importance, for a project such as this, of a thorough evaluation of alternatives and analysis of all relevant environmental impacts. The EIR should be the vehicle for this evaluation and analysis—it can bring together in one place the diverse environmental considerations that affect this project. The Commission recommends that each of the issues identified herein be given full consideration and treatment in the EIR, along with the many issues raised by others who have commented on the project. We hope that the EIR will demonstrate that this project can be carried to completion in such a way as to avoid

adverse environmental impacts to the greatest extent possible, and to minimize the impacts when avoidance is not possible.

The Commission appreciates the opportunity to comment on the ENF, and looks forward to the opportunity to review the draft EIR in a few months.

Grafton Conservation Commission

David C. Robbins, Chair

TOWN OF GRAFTON

GRAFTON MEMORIAL MUNICIPAL CENTER
30 PROVIDENCE ROAD
GRAFTON, MASSACHUSETTS 01519

RECEIVED
SEP 2 1992
MEPA

PLANNING BOARD

August 28, 1992

Attention: MEPA Unit
Secretary Susan Tierney
Executive Office of Environmental Affairs
100 Cambridge Street, 20th floor
Boston, MA 02202

Subject: ENF#9154, Worcester Commuter Rail Extension Project

Dear Madam Secretary:

The Grafton Planning Board is pleased to support the Worcester Commuter Rail Extension Project currently under review before the MEPA unit. This is a large and complex project very much needed by the region and the state. The proposed Grafton commuter rail station is part of a sustainable development proposal targeted for the Tufts University Veterinary School and adjacent former state hospital lands located nearby; namely, a Grafton Biotechnology Research and Manufacturing Park. Not only will the station help Boston reduce its air pollution problem through the use of commuter rail, it will help Grafton's proposed Biotechnology park reduce its traffic generation by providing a mass transit alternative to get to and from work.

The Planning Board does have a number of concerns with the proposed Grafton station. We believe that all of our concerns can be addressed and offer them in the cooperative spirit which has characterized this endeavor to date:

- The size of the Grafton parking lot has been reported in the paper as between 250-300 spaces. 250 spaces are preferred Please give us an accurate reading on this issue.

- Traffic is an important issue. Will the MBTA replace the bridge over Pine Street and widen Pine Street? The Worcester Business Development Corporation is entering a Land Disposition Agreement with the State for a biotech manufacturing park off Pine Street. These repairs are needed to provide safe access from the proposed park to the MBTA station location. We would like the following reviewed during your scoping of the project:

  140/30/East Street; North Main/Bridge Street; Bridge Street/ Worcester; Worcester/N. Main; Westborough Rd./Shrewsbury St. (140).

- The Grafton State Hospital site is in the process of being nominated to the National Register of Historic Places by MHC. We are concerned with the aesthetics of the parking lot and station and of assuring their compatibility with the Victorian architecture of the State Hospital grounds. The MBTA can do an excellent job of designing a station and landscaping it to be compatible with its environs. They did this in West Concord and we would like the same done here.

- We want more detail on the landscaping proposed for the parking lots. Pavement without plants will not fly in this community.

Thank you for the opportunity to comment on this important project. The Planning Board remains ready and willing to work with the MBTA to make this project happen.

Sincerely,

Peter C. Lowitt, AICP
Town Planner

PCL/jg

JP

TOWN OF HOPKINTON, MASSACHUSETTS 01748-1260

OFFICE OF THE SELECTMEN

RECEIVED
SEP 28 1992
MEPA

September 24, 1992

Secretary of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
Att: MEPA Unit

Re: Worcester Commuter Rail Extension Project

Dear Secretary Hoyte:

The Board of Selectmen would like to submit comment, on behalf of the Town of Hopkinton, in regard to the MBTA's Environmental Notification Form for the Worcester Commuter Rail Extension Project.

The Board believes that a full EIR is required, due to the scope of the Project, citing, under 301 CMR, 11.25 "Review Threshold Categorical Inclusions" specifically #17, (in regard to total project cost) and #19, (involving # of parking spaces being provided and new daily vehicle trips generated). An additional need is presented in regard to Figure 1 and the impact of drainage swale and fencing on Cedar Swamp, in Westborough.

Studies showing the projected impacts of the proposed stations, with regard to traffic volume, traffic flow, lighting and drainage are of critical importance and concern and should encompass off-site impacts of increased traffic beyond the nearest intersection, to include other impacted roads and intersections. Studies should address both the impact on existing systems and measures that will be proposed to mitigate those impacts, including any infrastructure improvements needed.

Additionally, the Board has serious concerns regarding the MBTA's long term goal of siting a regional station at the intersection of Routes 495 and 90, which would utilize local streets in the area. The impacts of such a station on the environment and local infrastructure would be much greater and would also require strict adherence to the EIR/MEPA process.

Your consideration of these comments and concerns will be very much appreciated.

Sincerely,

Sally P. Snyder

Sally P. Snyder
Chairman
SPS/ek

RECEIVED
SEP 25 1992
MEPA

N3

Susan Tierney, Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, MA 02202

September 23,1992

Attention: MEPA Unit

Re: **EOEA # 9154, Worcester Commuter Rail Extension Project**

Dear Secretary Tierney:

On behalf of the Millbury MBTA Advisory Committee, I submit the following comments on the Environmental Notification Form (ENF) for the above referenced project.

While the Committee generally supports the extension of commuter rail, and hopes that the Commonwealth will continue to pursue this public transportation option, it has several concerns about the proposed MBTA commuter rail station in Millbury.

TRAFFIC

The proposed MBTA station access would be located directly across from a Massachusetts Turnpike exit (Exit 11), which is located on Route 122 in East Millbury. This road already carries a heavy traffic load. The estimated average daily traffic count in the MBTA's ENF is put at 15,743 (1989 figures). Figures from a Central Massachusetts Regional Planning Commission traffic count on Route 122 in 1991 put average daily traffic at 25,268, which represents a 60% increase over the 1989 figures.

The ENF also states that "access through a residential neighborhood is not required for any of the sites". The area of East Millbury is essentially residential in nature. In fact, the proposed access road will require the taking of one residence and will route station traffic in the proximity of a neighborhood which has approximately 80 children. The proposed parking area will be located within 200' of another residence.

Another issue is that of potential expansion of the parking area, both in regards to increased traffic and the long-term impacts on community housing and the built environment. The Committee has been told by the MBTA that the Millbury site was originally slated to have 700 parking spaces. This number was scaled down in part because of the potential effect on the Peter Pan Bus Line, which operates out of the park-and-ride at Exit 11, as well as concerns raised by the City of Worcester. It is evident that the MBTA realizes that the Millbury site has the potential to be much larger than it is presently configured. Also, with the liklihood that the Union Station site in Worcester will not come on line coincidentally with the Millbury station, there is the potential that Millbury will see much of the ridership slated for the Worcester site.

The Committee feels that a much more detailed analysis through an Environmental Impact Report (EIR) is warranted for the impacts of traffic, the constuction and long-term impacts on the affected neighborhood, and the impacts associated with any potential expansion of the Millbury commuter rail station.

WATER QUALITY

The ENF also contained inaccurate information about the potential effects on water quality at the Millbury site. It stated that there would be no "increase in impervious or paved surface over a sole source aquifer or an aquifer recognized as an important present or future source of water supply". In fact, the parking area is over a portion of a Zone II of Millbury's groundwater aquifer.

Another inaccurate statement was that there are no public or private water wells within a 1/2 mile radius of the project. A majority of the single family residences within the 1/2 mile radius have their own private water wells.

SITING ALTERNATIVE

The Committee has put forward an alternative to the proposed station site and access road off of Route 122. The alternative would place the parking area on the North side of the Conrail track with access off of Route 20 in Worcester. The MBTA has verbally committed to afford the alternative proposal the same level of analysis as will be given to the original site. As the Town of Millbury was not informed of its selection as a host to a commuter rail station until May, 1992, the Committee requests that the MBTA give the same level of scrutiny to both sites in Millbury.

In conclusion, the Millbury MBTA Advisory Committee urges MEPA to require preparation of an EIR for this project with the scope to address the concerns not only of Millbury, but of all the affected communities.

Sincerely,

Stephen R. Bishop

Stephen R. Bishop
Millbury Town Planner

THE TOWN OF SOUTHBOROUGH

BOARD OF SELECTMEN
Town House, Box 9109, Southborough, MA 01772-9109 508-485-0710

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SEP 28 1992
MEPA

September 24, 1992

Ms. Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge St.- 20th Floor
Boston, MA 02202

Attn: MEPA Unit

Dear Secretary Tierney:

This letter is the Town of Southborough's official response to your request for public comment on the Worcester Commuter Rail Extension Project (MEPA Project #9154).

Selectmen appointed an MBTA Station Study Committee in May 1992, after the Mass. Bay Transportation Authority first contacted the town about the possibility of serving as a station location. Our committee has met regularly with local department heads, property owners, abutters, neighbors, regional agencies and other communities proposed as station sites. Representatives of the MBTA have also attended four meetings in town and have been helpful. The comments outlined below are a direct result of this Committee's research.

First, the town disagrees with the MBTA statement found at the outset of the ENF "that an EIR is not categorically required". According to MEPA regulations regarding thresholds for categorical inclusion, item twelve stipulates any new rail right of way ...OR extension of existing rapid transit line...must file an EIR. Although it can be argued that the parking and traffic thresholds are spread out over several locations and therefore should not be triggered, it is clear that rail extensions were intended to file full Environmental Impact Reports.

Second, due to the number of communities involved, the interrelationships of siting decisions in each community and the need for a structured intermunicipal response mechanism throughout the various stages in the review process; the Town of Southborough requests that you designate this "a major and complicated" project. This should facilitate the flow of information, highlight the ramifications of decisions in one community upon surrounding communities, establish interim site planning review meetings and provide for a format for continuing the efforts to build a regional station along the I-495/Mass Pike Corridor.

Assuming that the MBTA will be categorically required to submit an EIR, we have outlined issues that we believe need to be better addressed or were omitted from the ENF. Most comments specifically address the Southborough station, but at the end we also address the Ashland and Westborough sites.

REGIONAL STATION

The initial Feasibility Study for this project proposed a regional collector station with a 1,000 car parking facility at the intersection of I-495 and the Mass. Pike along the Hopkinton/Westborough border. For numerous reasons this site was dropped, but the need for a major collector station along I-495 is undisputed. The MBTA states in the ENF that they will continue to study the issue, but it provides no commitment to a timetable, process or actual implementation. Since the regional station would alleviate traffic on local residential roadways, possibly decrease the number of local stations needed, and/or impact negatively on currently proposed stations that would be operational before the regional station is constructed; the EIR must be more specific concerning the MBTA efforts to construct such a facility and its interrelationships, once operational, with at least the Westborough and Southborough locations presently proposed.

ASSESSMENTS

Although MEPA has traditionally covered only environmental issues in an EIR scope, the MBTA has expressed a willingness to include potential financial assessments in their EIR.

Present law stipulates that MBTA expansion communities will not be assessed. However, all indications are that this will change. Mr. Healy, Executive Director of the MBTA, recently stated that the goal is to have equitable assessments, with <u>all</u> communities receiving transit services paying a fair share for such service.

Therefore, the five communities (Southborough, Westborough, Millbury, Grafton and Worcester) currently outside the MBTA service area should be provided with realistic estimates of future assessments, if drawn into the MBTA system. For instance, Southborough is operating at its Proposition 2 1/2 limit, therefore, any new assessment would have to be defrayed by decreasing allocations to existing line items.

The EIR should provide a computer model that projects future assessments (under the existing formula) for all communities in the new system. Since the MBTA currently has the Old Colony extension underway, in addition to the Worcester extension, the assessment model should at a minimum include the 78 existing communities and all communities included in these two extensions.

We are also aware that high priority is being given to a Newburyport extension. We recommend that this extension also be included in the assessment model. Present plans are for the MBTA

service area to nearly double from 78 cities and towns to 138. Sixty new communities with new services should drastically impact municipal assessments.

VEHICULAR TRAFFIC

Southborough's foremost concern is traffic and its impact on the surrounding neighborhoods. It should be understood that Southborough does not want to become the "de facto" regional station. Any station constructed should be done on a "village scale" reflective of the existing Village Business zoning district.

Unlike other proposed station locations, Southborough was not included in the Feasibility Study for this particular extension. (Actually Southborough was included in the study proposing reactivation of the Framingham to Marlborough spur through an entirely different section of town.) Thus, the town has not even been provided with basic ridership projections for this station. The EIR must address:

1. total ridership
2. communities from which riders will come
3. most likely access routes into town
4. percent of riders that will be using the station during peak commute hours versus general daily figures
5. number of parking spaces needed to accommodate projected ridership versus maximum buildout of the lot (400 spaces)
6. number of cars that will park versus the number that will enter to drop off commuters and then leave again. These demand figures are more reflective of traffic than an artificial control factor, i.e., a 400 car parking lot.

At a public meeting held in town on September 10, 1992, residents spoke of the new Forge Park MBTA station in Franklin. In a very short time, this station has needed to have parking expanded three times. Residents fear that a 400 car station today will be an 800 car station within 5-10 years. Since the 400 spaces is calculated to meet the year 2010 needs, we request that the MBTA document the accuracy of its parking need projections for stations built during the past 20 years. MBTA officials present at the meeting indicated we should include this request in our ENF comments.

With this data in hand, the EIR must address what traffic mitigation measures will be required. Special attention should be given to Southville Rd, Route 85, Woodland Rd and the intersections of Southville Rd/Route 85 and Route 85/Route 9 for ramp failure. Mitigation should cover road widenings, turn lanes, improved signals, signage, sidewalks, one way streets, dead ends and similar traffic flow controls. For instance, the ENF site plan indicates that the Rt 85 bridge will have some reconstruction, however, the ENF does not explain what this entails. Is the reconstruction for the railbed or is it widening for a dedicated right turn lane? Will the roadway be lowered allowing truck traffic to get under the bridge? Please note that this bridge is the gateway to the town, therefore, Southborough

wants any reconstruction done to reflect the current architectural character of the bridge. This bridge is historic granite block. We do not want a "hi tech" Federal Highway standards bridge similar to what was recently done a mile east on Howe Street in Ashland.

The ENF projects an increase in daily traffic flow of 944 vehicles, however, it does not provide a source for this figure or for the existing 1992 daily traffic flow figures. We need the source for this information. We also believe daily averages are useless, if 80-90% of that flow will be arriving and leaving during peak commuter times. The MBTA knows this to be the case by the way they have scheduled their trains with twenty minute headways during peak commuting time and two hour headways during off-peak hours. Our roads will need to handle the traffic all at once, not spread out over twenty-four hours.

It should be noted that Southborough recently conducted its own traffic count and flow analysis at several intersections around the station. This was done both in July and in September. Despite the slow economy, traffic counts for peak commuting hours were higher than those conducted in 1987 during an economic boom. North/south flows already back up at lights for several light changes. This is the same intersection the new traffic would need to enter in order to access the parking lots.

PEDESTRIAN TRAFFIC

This site is near several residential neighborhoods, a K-1 elementary school, a church and neighborhood commercial uses. Sidewalks are needed to allow: commuters in nearby neighborhoods to walk safely to the station; children to access the existing fishing and skating pond next to the proposed parking lot and residents to walk to school and church functions.

An abandoned pedestrian underpass exists at the far end of the site. In the ENF site plan this underpass is shown, but there is also a new underpass indicated near the handicapped access facilities. The ENF is silent on whether both underpasses will be utilized. Since the existing underpass is near an existing recreational pond, which the MBTA has offered to enhance as indicated in the ENF, Southborough would like the abandoned underpass reactivated to provide safer access to this improved area. We also believe that the underpasses are safer for the commuters. Therefore, we want to discourage grade level crossings. One underpass at the far end of the lower parking lot will only result in commuters taking the stairs closer to them and crossing over the tracks.

LONG RANGE GROWTH IMPACTS

The ENF checked that the rail extension would have long range growth impacts. We would like them to elaborate on this and document these assumptions through existing studies. We asked the MBTA to provide us with studies that show that a new station improves a community, e.g., raising property values. However, they were unable to provide any such reports, especially for suburban communities.

We would also like an analysis on property values in station communities. Does the whole town benefit from increased property values, or do those residences within the viewshed of the station decrease in value? What has been the property value history in those communities where the MBTA has recently opened stations? Since property values everywhere increased in the '80's, did property near stations increase at the same rate as property elsewhere in the community?

Another long range growth impact is the potential for Reverse Commuting. Again Southborough has raised this issue with the MBTA. They agreed that having all A.M. trains start in Worcester and head to Boston eliminates the potential for workers using the trains to get to work west of Southborough, especially to Worcester. They agreed to do further study to determine if one (or more) trains should come out of Boston to enable A.M. commuting west and vice versa in the evening. This extension has been touted as an economic boon for Central Mass., in general, and in particular for Worcester and Grafton. Unless the trains serve local employers, they are really a way to decrease traffic and improve air quality in Boston. What are the long range growth impacts for Southborough and other Central Mass. communities?

BIKE TRAFFIC

Southborough has a series of bike trails crisscrossing town. One such paved trail is along Route 85 and stops two blocks from the proposed station at Richards Rd. The proposed site plan includes an area set aside for bike parking. Also, the new Surface Transportation Act encourages using other modes of transportation to decrease cars and help clean the air. Thus, the MBTA should study extending the existing bike path to the station. We also recommend that this path be continued a short distance south of the station to the entrance of the Hopkinton State Park.

DRAINAGE & WETLANDS

Statements made in the ENF regarding sedimentation, erosion control, runoff on site, grease traps, etc. are very good. Due to the project being so close to the Sudbury River, the Conservation Commission reserves its right to a full review prior to construction. It should also be noted that the site is so close to a floodplain that almost any alteration whatsoever would put the project into a floodplain. Further review of the lower parking lot access road is needed to be certain that it is not already designed in the floodplain.

HAZARDOUS WASTE

The ENF stipulates that a full Chapter 21E review would be done of all sites prior to purchase. The Town wants to call attention to the fact that the old foundation found on the lower part of the site was an old woolen mill that used dyes in its processing.

RECREATION & ANIMAL HABITAT

The ENF confirms discussions the town has had with the MBTA to enhance the natural habitat along the Sudbury River. The Mass. Division of Fisheries and Wildlife annually stocks this area, which

is a popular fishing hole for both children and adults. Thus, the ENF is in error when it says there are no fisheries. In addition, there are foxes, deer and especially blue heron living in this area. We do not envision any long term impact, but the EIR should verify this and discuss short term construction impacts.

Again, the town wants to go on record thanking the MBTA for the cooperation they have shown towards enhancing this area.

NOISE

The ENF does not adequately address the issue of noise. Yes, the tracks are improved and commuter trains make less noise than freight trains, but what is the existing noise level in this neighborhood? Will eighteen additional trains stopping and starting make more noise than the freight trains that merely pass through? If the noise is going to go up by more than 10% for the homes nearer to the station, what mitigation measures will the MBTA undertake?

AMENITIES

1. Fencing- we are pleased with the extensive fencing proposed as a way to avoid accidents. However, there will also be need for emergency gates interspersed along the route, including several at each station site. Since local emergency teams will be the first on the scene, e.g., Fire, Police and ambulance, these local officials should be provided with keys to these gates and should help with station planning in their communities.

2. Lighting- We want a well lit station to help reduce vandalism and car theft, and also provide for the safety of the riders. However, it's also important that this lighting does not disturb nearby residences. The ENF is silent on lighting issues. Just as EIR's must address shadows, this EIR should address overlighting impacts on neighbors and wildlife habitats.

3. Emergency phones- should be installed that automatically connect to police and fire stations.

PLEASANT ST STATION IN ASHLAND

Again, ridership projections are very important to Southborough. When Ashland was first proposed as a station, Southborough was not in the study. The MBTA should do a full ridership and traffic analysis to determine who will be using the trains in Ashland and how they will get there. We want special attention paid to Southville Rd, Oak Hill Rd and Central St in Southborough. If analysis shows increased traffic, then what mitigation is planned?

OTIS ST STATION IN WESTBOROUGH

Traffic flow projections for Westborough were done in 1990 when the site location was I-495. The station is now proposed for the opposite end of town close to the Northborough, Shrewsbury and Grafton borders. The majority of Westborough's population is closer to the Southborough station then the Otis St site, and traffic congestion is somewhat lighter in Southborough. Thus, commuters will come down Flanders Rd to Southville Rd. Also, Westborough residents out along the Upton and Hopkinton borders will be able to come along Rt 135 to Rt 85 in Hopkinton and enter the lower parking lot.

New ridership projections are needed based on the new Westborough location, and an analysis of ridership shift to Southborough. Without this work, there could be a gross under projection of demand versus capacity at the Southborough station.

VOLUNTARY REVIEW

Many of the comments in this letter could be placed in the category of site design more than environmental impact. However, we included them in our comments for two reasons:

1. They were addressed in the ENF and, therefore, were opened up for comment; and/or

2. The MBTA is not required to conform with local bylaws. Thus site design, safety, etc. must be raised now.

Southborough proposes that the MBTA voluntarily meet with local permitting boards at various stages in the project to receive feedback on their designs and proposed operations. If the MBTA would agree to such meetings much of the upfront detailed information could be developed at a more appropriate stage in the project. Again, the designation of "major and complicated" would establish an advisory committee that could work with the MBTA on an ongoing and cooperative basis. This would also give the communities more comfort that the MEPA review process would remain open and protect them, since so much of the necessary data is missing at this ENF stage.

Thank you for providing Southborough with an opportunity to comment on this very important project. Since the ENF deliberately discussed onsite considerations only, we hope that our comments have been helpful in detailing significant off site impacts generated by this rail extension. We hope that the Scope you issue will require a more thorough review of the impacts. We remain ready to meet with you or your staff to discuss this project further.

Yours truly,

Janice C Conlin

Janice C. Conlin
Administrative Assistant
to the Board of Selectmen

JCC/jf

cc: Larry Paretti, MBTA Project Manager
MBTA Advisory Committees in Ashland, Westborough, Millbury, Grafton
Metropolitan Area Planning Commission
MetroWest Growth Management Committee
Central Mass. Regional Planning
Selectmen: Ashland, Grafton, Westborough, Hopkinton, & Millbury
Mayor of Worcester
Mayor of Marlborough
Larry Gomes, Westborough

TOWN OF WESTBOROUGH
MASSACHUSETTS

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SEP 15 1992
MEPA

CONSERVATION COMMISSION

TOWN HALL, WEST MAIN ST.
WESTBOROUGH, MA 01581

September 14, 1992

Secretary
20th Floor
Executive Office of Environmental Affairs
100 Cambridge St.
Boston, MA 02202

Att: MEPA Unit Project #9154

Dear Secretary Tierney,

The Westborough Conservation Commission has several environmental conserns relating to the Worcester Commuter Rail Extension Project, which we believe cannot and should not be addressed only at the local level.

1. "Chain link fencing of the right-of-way."

Westborough Conservation Commission is particularly concerned in the Cedar Swamp (ACEC) area and the Suasco area. The Commonwealth needs answers up fron as to how Cedar Swamp will be affected.

2. "No significant environmental impacts are anticipated"

This statment is premature. The designated site, Smith Valve Parkway is immediately adjacent to and a part of a former creosote treating plant that is a federal (21 E) super fund cleanup project. A complete and accurate accounting of this area should be required.

3. Hocomoco Pond (a great pond)

This pond has already been adversely affected and damaged by creosote, a study of the Smith Valve station needs to address the potential for further creosote contamination.

4. Aquifier Zone

While the Smith Valve station may be 1000 feet from the zone II of three town wells; the station will be extremely close to the

S.U.A.S.C.O. Again a study must be required to ensure that creosote contamination will not enter the S.U.A.S.C.O. The three town wells draw water indirectly from the Suasco Reservoir.

In summation the Westborough Conservation Commission has addressed four major areas of serious environmental concerns there more than likely are others that will come to light during a detailed walk-over of the railbed and a study of more through plans.

The Westborough Conservation Commission on September 8, 1992 voted 6-0 to request that an Environmental Impact Report be required to fully address these and other Concerns.

Very truly yours,

Michael M. Maddocks, Chairman
Westborough Conservation Commission

JD

TOWN OF WESTBOROUGH
MASSACHUSETTS

OFFICE OF THE PLANNING BOARD
TEL. (508) 366-2811

TOWN HALL
34 WEST MAIN STREET
WESTBOROUGH, MA 01581-1998

September 4, 1992

RECEIVED
SEP 8 1992
MEPA

Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, Ma. 02202

Attention: MEPA Unit,
EOEA No. #9154

Dear Secretary:

The attached summary and text from a recent Westborough Planning Board public input meeting reflects the concerns of those present. The Board has unanimously voted against siting the proposed MBTA station at the Smith Valve-Otis St site in Westborough. The Westborough Planning Board requests that you require an Environmental Impact Report for EOEA Project #9154, the MBTA Worcester Commuter Rail Extension Project.

Respectfully submitted,

Sandy Spinella

Sandy Spinella
Secretary to Planning Board

cc: MBTA
Westborough Board of Selectmen
Westborough Conservation Commission
Westborough Historical Commission
Westborough Police Department
Westborough Fire Department
Westborough School Department
Westborough DPW
Westborough Advisory Finance Committee
Westborough Board of Health
Metro West
Central Mass Regional Planning
Judith McCabe

* If the Town does approve the Smith Valve site, would they be willing to improve the roads that will be used? (Mill Rd., Arch, Fisher and Maynard St.).

* The Town should continue to monitor and contribute input into the process. It is important to know the concerns of the residents of the Town.

* The present rail system is functioning successfully as a freight rail. Now we are going to ask this same system to carry passengers and freight. Three or four years ago the railroad ripped up a second set of existing tracks and the system is now functioning on only one set of rails. This will increase the risk of accidents by increasing the traffic on the single rail. Maybe the MBTA should restore the other track to use exclusively for the passenger rail. The residents of Westboro should not be sacrificed for the greater good of others. Suggests putting a station next to major state roads like Rte 495. The Committee needs to take another look and come up with a different solution.

* Concerned about increase of vandalism to surrounding areas near the proposed site.

* If there are going to be 210 riders a day, what kind of revenue will this generate? Is the MBTA service through Westboro going to run at a deficit? What happens if Westboro does not approve the site right now?

* At the corner of the Route 9/Otis Street intersection, the level of service is F. The proposed increased traffic to the MBTA Smith Valve stop will cause grid-lock. The level of service is F during peak hours and suggests that the MBTA may not be able to afford fixing this intersection back to its pre-station conditions. There will probably have to be grade separation of Otis St/Route 9. There is no other way of dealing with this problem. The Smith Valve site will go down the tubes if MBTA has to mitigate the traffic situation of Route 9/Otis Street intersection. The MBTA will have to find another place to put the station.

* Who will the commuters be? This will be an unfair burden to Westboro to have two stations. Residents are afraid of a constant increase in the number of cars to the current roads. The Towns infrastructure, and communities surrounding the Town, will be using the current roads. Opposed to the Smith Valve site selection but is not opposed to MBTA coming into the Town. It should be for the benefit of the Town and not surrounding communities.

* Marlboro and Southboro are both pushing to have a large regional parking lot in Westboro. There was a lot targeted by the MBTA on Northboro Road and is located about where the bridge construction is being done on Route 495. This option should be studied closer because if it was implemented, it would draw a lot of traffic from Northboro, Marlboro, etc. to that site and lessen the impact to the other area.

Dennis O'Neil, 10 Mohawk said that his concerns are financial. In this current economic environment we can't stand much deficit spreading from the MBTA, this is his concern as a citizen of Westboro. They are talking of a ridership of 100 residents from Westboro with 210 by the year 2010, how many other total people will make up the station in Westboro? This doesn't seem very economically viable to the Town. What will be the future costs to the Town? What will the real cost be to participate. He would like to see the gain, benefit, for the money that it will end up costing the residents of Westboro.

Member Billman-Golemme said that under the current system, 25% of a formula is based on how many people will use the station and then how many people in the town commute. If Westboro is to be part of the 78 Towns that make up the MBTA area, these Towns will all have to share the entire burden of the rail system.

Mr. Bob Tufts said that he thought that there was not going to be an assessment of the Town if we brought the MBTA in.

Member Billman-Golemme responded that under Section 12, Chapter 16, 161A, the Town will not be accessed because the Town is currently not in the MBTA Region. Member Billman-Golemme feels however, that the Town will be asked to carry their fair share.

A resident of Charles Street responded that he is also a member of the MBTA Committee. An assessment has to come from the State legislature. The Town could still be assessed and not have a station. The tracks already run through Westboro. Senator Amorello did do a district wide poll and everyone was sent a copy in the mail and a chance to respond.

Mr. Tufts said he feels everyone is interested in using the rail system, but he does not want to get caught up in the union issues.

Member Billman-Golemme said that Secretary Taylor has an advisory committee which is looking at all Mass transportation over the next 20 years. She is sitting on this board but not representing the Planning Board. The inner core group (inside Rte 128) is looking to have people carry their fair share financially. Residents should not make the assumption that Westborough in time will not be asked to contribute.

A resident at 147 Milk St. stated that the "survey" was part of Senator Amorello's District Newsletter that went out to every household. He personally is going to be a rider of the MBTA, he is in favor of it and feels that the committee did a good job. If there were to be two sites, this would split up the impact of traffic to an area. If the Town wants a station, the site should be close enough for all to be easily able to use.

Mr. Steve Doret clarified that the responsibility of the Advisory Committee is to list the drawbacks of an MBTA station to the Town so that it could be analyzed and know all the good and bad points.

Jeff recommended that the Board wait to sign lot releases until after recording of all documentation.

Attorney Alan Dodd stated that the Tri-Party Agreement can not take effect until after all parties of interest have signed, and that lots should not be released until after the Tri-Party Agreement is fully executed.

Member Doyle motioned to Approve the Tri-Party Agreement in the amount of $470,000 approved by Town Engineer; and with approval of both Town Treasurer and Town Counsel. Member Billman-Golemme seconded the motion and all 5 Board members voted in favor. The Board signed the Tri-Party Agreement and it was notarized.

Attorney Alan Dodd brought to the attention of the Board Attorney Michael Sowyrda and Dave Williams representing Powder Hill Estates located off of Milk Street. Attorney Dodd said that he has spoken with them and their construction date has run out thus forcing them to need a hearing date for an amendment to their Special Permit.

Jeff stated that the deadline for a public hearing from the filing date of May 15, would be July 14th.

Attorney Sowyrda offered to write a request on an extension of time so the hearing date could be July 15, 1992.

Member Doyle motioned that the Board accept a written request from the developer to postpone the public hearing date to July 15, 1992 on Powder Hill Estates. Member Billman-Golemme seconded the motion and 4 Board members voted in favor, one Board was absent from the vote.

At 8:25 P.M. Member Billman-Golemme opened discussion on the MBTA project by clarifying for those present that the purpose of this meeting is to give the residents of the Town and people of surrounding Towns a chance to speak their thoughts on this project. The Board will then take the information and share it with the Selectmen. But the main purpose is to hear the thoughts of those present.

Mr. Bill Panas of 21 Maynard Street stated that if the Smith Valve site is used as the T-station, he is concerned that Fisher St., Maynard St., Mill Road will become major access roads into the parking lot of about 400-500 cars. That amount of traffic will be coming from all different directions. From the east and south, they will all be filing through Fisher St. and Mill Road. Mill St. has no sidewalks and is very winding. This will be unsafe for children walking to school. Is there any idea as to what will be the increase in traffic to this area?

Mr. Mike O'Bryan of the MBTA Advisory Committee responded that this committee was appointed by the Selectmen but no one was given specific direction. This Committee did everything on their own. They were given no funding. An MBTA feasibility study was done that shows Westborough as a desirable area. He does not know what the direct impact will be. The environmental study that the MBTA will be required to do will also include a traffic study. The Advisory Committee did get input from DPW and Town Engineer. In general the response was that Smith Valve was probably the best site available, of the sites for review.

Mr. Panas questioned that if there are probable objections to this or any other site, will there be something to fall back on?

Mr. O'Bryan stated that they made an 11 page report to the Selectmen listing various sites with pros and cons of sites. Recommendations of those sites were made.

Member Billman-Golemme said that there will be a list that will be produced from this meeting and shared with the Selectmen.

Mr. O'Bryan pointed out that at the Board of Selectmen meeting on June 23, 1992, the MBTA is coming. The residents should ask questions directly to the MBTA at this meeting.

Ms. Betty Tufts, 28 Maynard Street stated that these streets are too narrow and there are no sidewalks and a narrow railroad bridge. Maynard St right now is quick access to Fisher St. and Milk Street. Direct traffic is already terrible. She would like to see public transportation in Westboro but does not think that Smith Valve is the right site. By the time the train leaves Westboro, they will already be at the Grafton station. She is against this location.

Ms. Liz Colbert of 14 Maynard street asked if the Westboro residents will really benefit? This site will increase traffic and noise on Maynard, Mill and Fisher Streets. Mr. O'Bryan indicated that a survey was done. She did not receive a survey and does not know of anyone that did. She feels that the cost of increasing the fire and police protection, and the wear and tear on the roads out weighs the benefit of an occasional trip to Boston. (Note: 6/18/92 letter of Mrs. Cobert's concerns).

Member Billman-Golemme said that she does know that a statistic study was done.

Mike O'Bryan said that a feasibility study was done in the 1980's and was published and handed to the MBTA in January of 1990. The only numbers available were from "boom" times. The projected ridership at that time to the year 2010 is 210 riders in the year 2010 from Westborough. These figures can be found on page 15 of the Stone and Webster Report. Upton has a projected ridership of 30 and Norhtboro a projected ridership of 100. The study was done on the existing travel and roadwork at that time.

A resident at 129 Milk Street asked if there will be a Grafton station and a Westborough station? Why must two stations be so close together when it must be expensive for these stations to be built, and taking into account the ridership? It just doesn't seem that it would be that much out of the way to go to Grafton to get onto the T-line.

Mr. O'Bryan responded that Northboro residents that do not want to go to Southboro or Ashland, will use Westboro roads to get to Grafton. Parts of Shrewsbury would use Westboro roads. The distance between the two proposed stations is approximately 2 rail miles or about 1.8 miles. This is a decent distance. On many lines of the MBTA, there are stops that are less than a 1/4 mile apart.

Member Billman-Golemme stated that at one time the Grafton site was removed, but then was placed back. This is a reasonable question to ask. The two stations are close.

Mr. Steve Doret of 23 Mill Road said that his concerns are that a Committee representing the Town should analyze information for the people of the Town. This Committee should have gone to the Board of Selectmen and made them aware if there was a shortcoming or lack of information, funding, etc. It is unfortunate that this Committee was given no resources, no scientific study was done at all. This is important now from the Town's perspective to know what the cost is going to be the Town? What good is this to Westboro?

Mr. Mark Allen of High Street stated that he was on the MBTA Committee and the committee was made up of no engineering experts, planners, or technicians, just laymen. These people were all volunteers to consider a matter to the best extent possible. The MBTA, Westboro has the longest stretch from Framingham to Worcester. The MBTA is likely to very interested in siting a station in Westboro whether the Selectmen, and residents want it or not. It is better to pick or recommend a site than to have the MBTA place it wherever they want.

Mr. O'Bryan responded that the MBTA will be doing an Environmental Impact Statement. If they run into severe problems, they would withdraw the site.

Board of Selectman, Charles Kelliher stated that he has reviewed the correspondence to the Selectmen. There was only one piece of correspondence favoring the MBTA. The Selectmen gave the Committee a charge of selecting the site. In that charge, he does not think there was a charge to say whether they wanted it or not, but to just pick the site. The MBTA now thinks that the Westboro site is a good site selection. Westboro will take us. This vote has not been taken yet. There has been talk of another site planned 10-12 years out at the 495 belt. What will then happen to the Smith Valve site?

Jackie Cox at 11 Fisher St. said that Fisher, Arch, and Mayard Streets are all incredibly narrow, windy roads and not adequately equipped to handle a large increase in traffic. If the MBTA is considering a 495/Route 9 location, wouldn't this enhance people to use this station?

Ms. Paula Skog, Board of Selectmen said that she has only read maybe one or two negative written comments on the MBTA station. When she has spoken with residents of the Town, the response has been in favor of a station. The Committee gave the Selectmen a very lengthy list of things to have to solve if the Town was to have a station.

A resident asked if the Town does approve the Smith Valve site, would they be willing to improve the roads that will be used? (Mill Rd., Arch, Fisher and Maynard St.).

Mr. O'Bryan said that the MBTA told the Committee that they can not create traffic problems to an area that are worse than an existing one, if they do, then they will provide the money to mitigate the problem to at least return it to what it was pre-station. The Committee assumed when they recommended the Smith Valve site, based on the information they knew, that residents of Westboro, Northboro, Grafton and Shrewsbury would all use the station. The Selectmen have the ability to use signage to help correct any problems with traffic.

Kris Allen, Board of Selectmen stated that she has heard great support in the community for a station. She does agree that major studies should be done. The Town should continue to monitor and contribute input into the process. It is important to know the concerns of the residents of the Town.

Member Doyle said that the present rail system is functioning successfully as a freight rail. Now we are going to ask this same system to carry passengers and freight. Three or four years ago the railroad ripped up a second set of existing tracks and the system is now functioning on only one set of rails. This will increase the risk of accidents by increasing the traffic on the single rail. Maybe the MBTA should restore the other track to use exclusively for the passenger rail. The residents of Westboro should not be sacrificed for the greater good of others. He suggests putting a station next to major state roads like Rte 495. The Committee needs to take another look and come up with a different solution.

Mr. O'Bryan said that the plan is to restore the 12 mile stretch of track that was taken out. The freight service will not be allowed to slow down so both tracks will be running and they will probably insert the freight schedule into the passenger service.

A resident of Fisher St. is concerned about increase of vandalism to surrounding areas near the proposed site.

Mr. O'Bryan said that MBTA plans to install fences but it will be the local police that will be the security force. This should not be a problem.

Mr. Bill Panas said that Ms. Allen is right. There is much support in the community for a station. He suggests using the existing downtown station.

Mr. Bob Tufts asked if there are going to be 210 riders a day, what kind of revenue will this generate? This is going to be running on a loss. What happens if Westboro does not approve the site right now?

Mr. O'Bryan responded that MBTA can take by eminent domain. The Town should understand that MBTA wants a station in Westboro. It is in the best interest of Westboro to make a recommendation to MBTA. MBTA will come to Westboro regardless, so it is better to be able to recommend then have MBTA select the site.

Mr. Tufts said that there are already receptive towns and MBTA should deal with them first.

Member Billman-Golemme responded that the number of parking spots is needed to justify this route.

Ms. Sylvia Travis of 55 Church St. is concerned with the traffic on Fisher St., Milk St., etc. People should be getting involved and maybe the use of the rotary could be used to put signs up alerting residents of meetings.

Member Doyle stated that for the last 7 years the Planning Board has been approving projects on Route 9. A significant amount of development has been concentrated within the northern end of Route 9. The level of service of the Route 9/Otis Street intersection suggests that the Smith Valve traffic will fail, will cause grid-lock. Member Doyle suggests that the MBTA may not be able to afford fixing this intersection back to its pre-station conditions. There will probably have to be grade separation of Otis St/Route 9. There is no other way of dealing with this problem. The Smith Valve site will go down the tubes if MBTA has to mitigate the traffic situation of Route 9/Otis Street intersection. The MBTA will have to find another place to put the station.

Mr. O'Bryan suggests that Mr. Doyle attend the Selectmen meeting on the 23rd of June and bring up these points at the meeting to the MBTA.

A resident of the Town said that the community needs public transportation. Westboro needs and has to find a way to increase its public transportation network.

A resident asked why hasn't a site like 495 been selected so that more commuters to use?

Mr. O'Bryan said that originally the Fruit Street site was selected but it involved home takings and business takings. The Planning Board Assistant suggested a limited access facility strattling the Mass Pike and 495 site. The service has a deadline date to be in place by 1995-96. Chief Parker suggested having 2 sites. The information available needs to be shared better.

Kris Allen stated that there are long and short range views; the long range goal is a regional station on 495. The short term goal is for 250 spaces. It is important to get input on this.

Member Dunne summarized that the main issue is the increase in traffic on local roads in Westboro due to the station. He feels that 495 would be the ideal site. He has attended most of these meetings and feels that some people leaned towards the 495 site. The expense of the MBTA should not be a concern to Westboro.

Member Brady stated that Mr. O'Bryan and his group have done a fine job for the Town. He agrees that the Selectmen meeting should be attended on the 23rd of June and questions should be asked directly to the MBTA.

Member Billman-Golemme said that all the residents input is being recorded and will go to the Selectmen and send to the MBTA so they can be prepared for the meeting next week. Hopefully people will come to this meeting.

Mr. Charles Kelliher wants to thank the MBTA Advisory Committee for all the work and time put into this project.

A resident of Flanders Road stated that he has attended many of the MBTA meetings. Marlboro and Southboro are both pushing to have a large regional parking lot in Westboro. There was a lot targeted by the MBTA on Northboro Road and is located about where the bridge construction is being done on Route 495. This option should be studied closer because if it was implemented, it would draw a lot of traffic from Northboro, Marlboro, etc. to that site and lessen the impact to the other area.

Judy McCabe of 15 Maynard St. stated she is being impacted. She feels the Smith Valve site was picked by process of elimination. Who are the commuters to be? This will be an unfair burden to Westboro to have two stations. She is afraid of a constant increase in the number of cars to the current roads. The Towns infrastructure and communities surrounding the Town, will be using the current roads. She is opposed to the Smith Valve site selection but is not opposed to MBTA coming into the Town. It should be for the benefit of the Town and not surrounding communities. Ms. McCabe read into the record a petition she is circulating suggesting a Route 495 site selection.

Member Billman-Golemme said that a letter will be available either late Monday or Tuesday on the residents comments for the Board of Selectmen meeting.

Mr. O'Bryan does not feel that the Selectmen are going to vote on Tuesday. He recommends to the Board that the Selectmen move the meeting space for next Tuesday to a bigger location. He also recommends to the Selectmen to arrange to hold their public hearings with notice so that all can watch or attend. The MBTA Advisory Committee is not a decision making body on this subject. They simply

made a recommendation and that is all. The Selectmen will make the decision on the site selection. They will take the vote on where the site will or will not be. The MBTA may decide that the site will be elsewhere. They have this authority. The MBTA is coming to this meeting with a cooperative attitude but do not be surprised if they pick their own site.

At 10:05 P.M. the Board reviewed a draft decision on Cedar Hill Estates. Mr. Frank Stelmach could not be present so his Secretary and Candy Owen were present to speak for him.

Jeff walked the Board through the draft decision. Condition #1 presents a problem for Mr. Stelmach. It deals with the 3.5 Open Space acreage. Clarification is needed as to whether Mr. Stelmach may include this in his subdivision. It is a difference of 31 lots or 34 lots. Because this issue could not be resolved, the Board will wait on making a decision on the Concept Plan until clarification is received.

At 10:55 P.M. the Board discussed the draft decision of Piccadilly Mill Open Space Community.

Member Doyle suggested to save on time only commenting with questions on pages of the decision.

* Jeff suggested that the date for the decision be changed.

* Member Doyle said on page 2, leave out of paragraph #2 starting with "Certain aspects".... to end of paragraph.

* On Page 3. Member Billman-Golemme would like the specification of pavement width to be changed to "shall be" instead of "may be".

* Page 5, #15, Member Doyle said "more definite" should be "more definitive".

* Page 6, #17, Member Doyle stated that easements for future highway improvements need to be indicated. #18, Member Doyle suggested changing to "approval is conditioned upon construction of sewer trunkline" then finish the rest of the sentence but delete rest of paragraph. Member Doyle suggested in the second sentence inserting the wording "has the option to install the line".

* On #20, Member Doyle would like the clearing area to be a minimum of 12 feet.

Member Billman-Golemme would like to have Attorney Longden incorporate into the Conservation Restriction the wording "watershed preservation restriction".

Attorney Longden stated that it is in the document on the first page of the Conservation Restriction document.

* On Page 7, # 23-30, Jeff will lead Board through conditions.

SUMMARY OF PUBLIC INPUT ON MBTA DISCUSSION

* Concerned that Fisher St., Maynard St., and Mill Road will become major access roads into the MBTA parking lot of about 400-500 cars. The amount of traffic will be coming from all different directions. Mill St. has no sidewalks and is very winding. This will be unsafe for children walking to school.

* The streets are too narrow. Maynard St right now is quick access to Fisher St. and Milk Street. Direct traffic is already terrible. Would like to see public transportation in Westboro but does not think that Smith Valve is the right site. By the time the train leaves Westboro, they will already be at the Grafton station. Against this location.

* Will Westboro residents really benefit? This site will increase traffic and noise on Maynard, Mill and Fisher Streets. Feels that the cost of increasing the fire and police protection, and the wear and tear on the roads out weighs the benefit of an occasional trip to Boston.

* Will there be a Grafton station and a Westborough station? Why must two stations be so close together when it must be expensive for these stations to be built, and taking into account the ridership? It just doesn't seem that it would be that much out of the way to go to Grafton to get onto the T-line.

* Concerns are that a Committee representing the Town should analyze information for the people of the Town. This Committee should have gone to the Board of Selectmen and made them aware if there was a shortcoming or lack of information, funding, etc. It is unfortunate that this Committee was given no resources, no scientific study was done at all. This is important now from the Town's perspective to know what the cost is going to be the Town. What good is this to Westboro?

* There has been talk of another site planned 10-12 years out at the 495 belt. What will then happen to the Smith Valve site? If the MBTA is considering a 495/Route 9 location, wouldn't this enhance people to use this station? If there were to be two sites, this would split up the impact of traffic to an area. If the Town wants a station, the site should be close enough for all to be easily able to use.

* In this current economic environment we can't stand much deficit spreading from the MBTA. The MBTA are talking of a ridership of 100 residents from Westboro with 210 by the year 2010, how many other total people will make up the station in Westboro? This doesn't seem very economically viable to the Town. What will be the future costs to the Town? What will the real cost be to participate? What will be the gain and benefits to the residents of the Town? THis will end up costing the residents of Westboro.

JD

TOWN OF WESTBOROUGH
MASSACHUSETTS

OFFICE OF THE PLANNING BOARD
TEL. (508) 366-3055

TOWN HALL
34 WEST MAIN STREET
WESTBOROUGH, MA 01581-1998

RECEIVED
SEP 29 1992
MEPA

September 23, 1992

Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, Ma. 02202

Attention: MEPA Unit
EOEA No. #9154

Dear Secretary:

The Westborough Planning Board would like to reinstate their position on disapproving of the Smith Valve Site. The Board is not in favor of investigations or ramifications about the potential of looking into a regional station in Westborough until the MBTA establishes a policy regarding regional assessments.

Respectfully submitted,

Sandy Spinella

Sandy Spinella
Secretary to Planning Board

SD

RECEIVED
SEP 9 1992
MEPA

Westborough Historical Commission
Town Hall
Westborough, Massachusetts 01581

3 September 1992

Secretary Susan F. Tierney
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Attn: MEPA Unit EOEA # 9154

RE: MBTA Worcester Commuter Rail Extension Project:
Westborough Station site, Smith Valve Parkway

Dear Secretary Tierney:

The Westborough Historical Commission and its Principal Investigator, Dr. Curtiss Hoffman, have reviewed the Environmental Notification Form for the proposed project referenced above.

The project area in Westborough is considered to possess a strong probability of containing significant archaeological deposits. Since the area has not been systematically examined by archaeologists, no archaeological sites have yet been recorded within the project. In New England, archaeological sites are usually buried in the soil and require methodical test excavations to be identified.

The archaeological sensitivity of the area is predicated on the existence of eleven (11) known prehistoric Indian sites in surveyed areas around Hoccomocco Pond and near the Assabet River. The known sites in the area date to the Middle and Late Archaic periods, 3,000 to 8,000 years ago. At least two 18th and early 19th century historic homes are located within the proposed impact area.

Therefore, we request that P2, Section E note that "construction impact" will occur to Historical/Archaeological area. Further, that an EIR be required in order that an intensive (locational) archaeological survey (950 CMR 70) can be included in the scope of the project. The survey would locate and identify any significant cultural materials which may be affected by the project.

Sincerely,

Jacqueline C. Tidman
Chairman

cc: MBTA
Brona Simon, State Archaeologist
Dr. Curtiss Hoffman
Board of Selectmen
Planning Board
Conservation Commission

(11)

TOWN OF WESTBOROUGH
MASSACHUSETTS

RECREATION DEPARTMENT
FRANK J. DESIATA
DIRECTOR

TOWN HALL-WEST MAIN STREET
WESTBOROUGH, MA 01581-1998
TEL. (508) 366-~~4802~~ 3066

RECEIVED
SEP 8 1992
MEPA

Sept. 3, 1992

Dear Ms. Tierney, --

I would like to be counted as a person who feels an "E.I.R." must be done by the MBTA for the Worcester Commuter Rail Extension Project. I find it almost unconscionable that one might even consider not conducting one. This is the 1990's, hopefully we think more today than we did years ago. This Town has already given up much for our State more than most! Please do use some justice; we deserve to have all the facts out in the open. I ask that you do the right thing. At a time when our governing officials are not always looked up to, you have a chance to show us your department is one that still cares what "The people" think. Thank You for your time and consideration.

Sincerely
Frank DeSiata

JD

TOWN OF WESTBOROUGH
MASSACHUSETTS

TOWN ENGINEER
JOHN H. GOODHALL, JR., P.E.

RECEIVED
SEP 10 1992
MEPA

131 OAK STREET
WESTBOROUGH, MA 01581-3317
TEL. (508) ~~XXXXXXX~~ 366-3070
FAX NO (508) 366-3074

September 8, 1992

Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, Massachusetts 02202

Attention: MEPA Unit

SUBJECT: MBTA Worcester Commuter Rail Extension Project
EOEA No. 9154

Gentlemen:

I have reviewed the ENF submitted by the MBTA for the subject project. In my opinion the information provided in the ENF is not complete. Also, I do not feel there is enough information to enable your office to make a decision. I respectfully request your office require an EIR to optimize the availability of information.

It is indicated on the second page of the Project Description Narrative, 2nd paragraph under Station Locations/Layover Facility, that access is not required through a residential subdivision. I believe that some traffic will gain access to the Westborough Smith Valve Parkway site by Arch Street, Glen Street, Gleason Street, South and Walnut Streets in Town of Shrewsbury, Fisher Street, and Mill Road. These roads are all predominantly residential in use and zoning. In addition, an elementary school is located along Fisher Street. Children walk to and from school along Fisher Street.

There are several roads whose capacity is at or over capacity due to the railroad system. The bridges over East Main Street, Water Street, Maynard Street, and Arch Street are antiquated and narrow. The Fisher Street bridge over the tracks has been condemned. Traffic flow is hindered through these bridges. At least two traffic studies have been done in recent years, both stated that the traffic problems along East Main Street can not be significantly mitigated until the bridge is upgraded. Now, several of these streets will have additional traffic over them as a result of the project.

Where in the ENF is the existing Otis Street Well (public water supply) addressed? This well is about 1/2 mile from the site which is closer than the three wells mentioned on page 6. In addition, there is a future well which should have been addressed.

September 8, 1992

Secretary
Executive Office of Environmental Affairs

Attention: MEPA Unit

SUBJECT: MBTA Worcester Commuter Rail Extension Project
EOEA No. 9154 (continued)

Based upon scaling on map provided in the ENF and cross-referencing the Assessors' Map, the Town appears to own about 0.6 acres of the proposed site in Westborough. Have the Board of Selectmen agreed to transfer this Town property? Will the MBTA take this property from the Town? Is this property connected with the Superfund Cleanup across the street?

Thank you for your time and consideration.

Very truly yours,

John H. Goodhall, Jr.
Town Engineer

JHG/jfk

cc: Board of Selectmen
Planning Board
MBTA

JD

WESTBOROUGH PUBLIC SCHOOLS

22 Phillips Street • Westborough, Massachusetts • 01581 • (508)366-8551

RECEIVED
SEP 2 0 1992
MEPA

September 18, 1992

Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, MA 02202

Attn: MEPA Unit

Dear Secretary:

This letter is written on behalf of the Westborough School Committee concerning the impact of the proposed MBTA station and parking lot at the Smith Valve site in Westborough. The Westborough School Committee voted unanimously at its public meeting of September 9, 1992 to share our concerns with you.

The Westborough School Department currently operates two schools on Fisher Street, located within close proximity to the proposed M.B.T.A. site. The schools currently house 692 students in Grades 5-8. All indications are that these numbers will increase substantially over the next few years. Of these students approximately 200 walk to school on a daily basis. We have 13 full-size busses and three vans transporting the other children to and from the schools.

We are concerned about the impact which the traffic heading to and from a 600 car parking lot will have on the safety of the children walking or being transported to and from the schools. One of the major roads leading to the schools, Maynard Street, is a very narrow street with no sidewalks. Maynard Street currently has a large automobile and truck traffic volume and is used as a shortcut to Route #9 by morning commuters. In addition to the students walking to these two schools, there are a number of students waiting to be bussed to their individual schools along many narrow streets leading to Fisher Street. Many of these students are of elementary school age, Kindergarten - Grade 4.

At its September 9th meeting, the Westborough School Committee established some safety priorities and respectfully suggests that you consider the following:

- reduce the size of the lot from 600 to 300 cars;
- improve the sidewalks and crosswalks in the location between the lot and the neighborhoods surrounding the schools;
- provide funds to offset the cost of any additional crossing guards or bus routes which are deemed necessary to ensure the safe transportation of our children.

If you have any questions or need any additional data or information, please contact either Dr. John P. Doherty, Jr., Superintendent of Schools, or Mr. Les Olson, Business Manager. They may be reached at the Harvey Administration Office, 22 Phillips Street, Westborough, MA. 01581. The telephone numbers are 508-366-8551 or 508-836-7702.

Sincerely,

Sheila R. Cizauskas

Mrs. Sheila Cizauskas
Chairperson
Westborough School Committee

cc: Mass Bay Transportation Authority
Westborough School Committee
Westborough Board of Selectmen
Westborough Advisory Committee M.B.T.A.
Senator Matthew Amorello

CERTIFIED MAIL

JD

TOWN OF WESTBOROUGH
MASSACHUSETTS

BIRTHPLACE OF ELI WHITNEY

BOARD OF SELECTMEN

TOWN HALL
34 WEST MAIN STREET
WESTBOROUGH, MA 01581-1998
TEL. (508) 366-3030

RECEIVED
SEP 29 1992
MEPA

92-765

September 23, 1992

Attn: MEPA Unit
Secretary Susan F. Tierney
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

RE: Worcester Commuter Rail Extension Project
E.O.E.A. No. 9154

Dear Secretary Tierney:

The Board of Selectmen of the Town of Westborough strongly recommends that the MBTA should prepare an Environmental Impact Report (EIR) on the MBTA proposed Worcester Commuter Rail Extension Project. E.O.E.A. officials at the September 15, 1992 public comment meeting indicated that an EIR would be required. The EIR should also be designated as "Major and Complicated" due to the size and scope of the proposed project, as well as the particular circumstances of the sites and the cumulative effects and interrelationships within the project.

One important point is that the Board feels that the decision to build a regional station must be made <u>before</u> the impacts of a potential local station can be determined; it will be impossible for the MBTA to make assumptions about the project's impacts without this information. The Town also requests that the MBTA be sensitive to diversification of the Mass Transit station system by allocating, if proven necessary, only one station to Westborough. The impact of a local and regional station due to the Town's favorable geographic location would be unfair.

The Board wishes to submit the following comments, which should be reviewed for inclusion in the EIR requirements.

One component should be an analysis of the purpose and need of the project, a more up-to-date detailed study to provide a description of the study area and existing transportation services, along with a demand and ridership analysis. The initial Stone & Webster Civil & Transportation Services, Inc. study does not utilize the now

available 1990 Federal Census information, nor the recent economic correction occurring in the Boston area. The new analysis should include the impact of one regional station only in the I-495 area, one local station at Smith Parkway, and the combination of the two (local and regional). The specific reference of where the passengers will come from, to the potential routes to be utilized for each of the above listed potentials should also be indicated. The ridership analysis should include the impact of other potential upcoming Commuter Rail Extension Projects, including the Franklin Branch from Forge Park (I-495/Route 140) to Bellingham and Milford. The analysis is important because demand could be reduced by the extension of a parallel line.

Another component should include a siting and alternatives analysis. The analysis should include a list of alternative sites and characteristics, identify screening criteria, describe application of screening criteria to each site, and based on the above, justify site selection and/or rejection. The regional station must be included in order to access the impact of a local station. The various potential combination of sites and how they will interact should be addressed. This type of analysis will allow the Board of Selectmen a better basis of decision making in this project.

Another component should include an assessment of the affected environment. The EIR should describe <u>in detail</u> the social, environmental, and economic conditions in the affected area. The current information provided in the Environmental Notification Form (ENF) is neglecting such information.

Another component is a detailed site analysis, which would consist of several elements outlined in the ENF on page 2, section E, and also detailed below:

A. WETLANDS and DRAINAGE: The EIR should require the identification of wetlands affected by possible railbed expansion and station construction. The Conservation Commission informed the Board that the Smith Parkway station site may be 1,000 feet from the Zone II of THREE Town wells. The potential impact on Hocomonco Pond (a Superfund Cleanup Site), SUASCO Reservoir proximity, future well site activity, private home wells, and Great Cedar Swamp A.C.E.C. area needs to be greatly assessed and mitigated to prevent any potential contamination.

B. TRAFFIC: The traffic generation analysis, along with original distribution of traffic should analyze intersections and roadway links with traffic attributable to the project up to 10% of total. The analysis should study the impact of the regional station, along with the potential local station. The study needs to account for increased vehicle utilization recently occurring via Sam's Club opening and future increases created by Astra Pharmaceutical's 10 year growth plan, along with future development on the northwest corner of Otis Street and Route 9. The Board is concerned about traffic impacts on Otis, Fisher, Maynard, Arch and Gleason Streets, and Mill Road to list a few. The Town Engineer has informed the Board that, "There are several roads whose capacities are at or over capacity due to the railroad system. The bridges over East Main Street, Water

Street, Maynard Street, and Arch Street are antiquated and narrow. The Fisher Street bridge over the tracks has been condemned." Route 30 (East Main Street) rehabilitation is extremely restricted pending bridge upgrade. The ENF sites an increase of 1,416 vehicles per day for the already hazardous Route 9/Otis Street station, with a potential of double that coming into a regional station in the vicinity of Route I-495. The ENF does not address pedestrian traffic allowance or school children walking in Traffic Impact Areas.

C. ARCHAEOLOGICAL RESOURCES: The ENF indicated no potential impact on Historical/Archaeological areas, according to page 2, section E. However, the Selectmen have received comment from the Historical Commission that "the project area in Westborough is considered to possess a strong probability of containing significant archaeological deposits." The Charlestown Meadows Archaeological Site, located at the intersection of Gleason and Arch Streets, is an active site within 3,000 feet of the proposed location on Smith Parkway. Two historic homes are also in close proximity. This issue needs to be studied in more detail.

D. TERRESTRIAL AND AQUATIC ECOSYSTEMS: The EIR should require impact analysis on Rare and Endangered Species, along with Area of Critical Environmental Concern (A.C.E.C.) in Great Cedar Swamp. The fencing allocation of the ENF along the entire route has the potential of obstruction of wildlife corridors. The SUASCO Reservoir is an area rich in aquatic and land wildlife.

E. AIR QUALITY: The ENF identifies a positive on air quality provided new locomotives (F40e) are utilized. This makes the assumption that all trains will be of the newer variant. Will this always be the case, or will the backup, older locomotives (F40's) variation, be used? The ENF does not address additional auto emissions from 1,400 daily car trips to Westborough, with an additional 2,800 from a regional station to their respective affected neighborhoods. Nor does it provide a good comparison to the alternative, which is progress toward the 1995 target for significantly cleaner auto emissions.

F. NOISE AND VIBRATION: The locomotives and additional vehicles will create a noise and vibration impact greater than currently exists. The older F-40 engines emit approximately 86 decibels in passby tests according to our MBTA Advisory Committee. The locomotives will also be stopped for prolonged periods to allow for the entraining and detraining of passengers on site. Noise will be greater with stops and starts. The site location does not include any noise barriers, yet residential neighborhoods are close by to the proposed station. Property values and the community as a whole may be affected if the environmental change is significant.

G. CULTURAL AND COMMUNITY RESOURCES: The proposed project, when taken in conjunction with a regional station, will alter the affected portions of Town by providing inflow of traffic to utilize the proposed station(s). The Smith Parkway site will impact the rural neighborhood and school area located to the south and southeast of the site. The Town's governmental infrastructure (Police, Fire, DPW, other) will be required to provide resources to the facilities directly and to traffic route areas to the facilities.

The financial impact to the Town (if incorporated into system) will adversely affect the Town's Government Resources. The potential assessment which could have been levied on the Town in FY91 was projected at $339,262.00 for a local station only. If legislation is changed (which is likely), future costs could be much more; the current municipal assessments only account for about 16% of the costs net of farebox receipts. The Town was legally eligible under Proposition 2 1/2 to increase Property Taxes by $743,099.00 between FY91 and FY92 fiscal years. The Town's current (FY92) total State & County Charges and Assessments total approximately $100,000.00. The MBTA assessment would overwhelm the available revenue needed to cover all budget growth caused by inflationary factors. The mitigation of this factor would be critical to the Town's financial resources stabilization. The consideration of increases in assessment along with a regional station assessment impact need to be addressed.

H. COMMUNITY DISRUPTION: The impact on community disruption would be significant in the area detailed by the ENF. The proximity of residential neighborhoods along with the two schools where children would have to walk on roadways without sidewalks. The initial reaction to the proposed location is a hint of initial community disruption. Mitigation measures along with site alternatives including a regional station must be considered.

I. ECONOMIC AND SECONDARY DEVELOPMENT: The economic development impact on the Town would likely be negative from a loss of taxable property located in an industrial area to increased services requirements along with a cash flow loss (via the potential assessment). The initial 1990 MBTA report indicates commuter traffic to Boston is the primary use of the railroad. Business would not prosper because the reverse commuter traffic (to Westborough from Worcester/Boston) would be minimal, according to the MBTA report.

J. SAFETY AND SECURITY: The potential public safety and security issues pertain to traffic related problems (accidents, theft, vandalism, lockouts). The security for the parking facility area has not been addressed, however, it is believed that the Westborough Police and Fire Departments would be responsible for coverage. There is concern for safety of children crossing the tracks even after installing the proposed six foot chain link fence, and the safety of commuters who may cross the tracks if a gauntlet track is installed and not an intertrack fence. The signaling component is of a concern as faster (70 mph) commuter trains are intermingled with slower (50 mph) freight trains.

An additional component must be the Identification of Mitigation Measures for all identified impacts listed above. Mitigation measures, such as the rehabilitation of railroad bridge(s), the installation of noise barriers, roadway reconfiguration, sidewalk installation, the Town's rights to parking fee collections, the Town's dual ownership on deed restrictions, and related concerns, should be thought out carefully to minimalize the impact on the community. The true beneficiaries of the station(s) are out of town commuters who decide to utilize public transportation and not their own automobile transportation.

The Board of Selectmen requests the inclusion of the above mentioned materials into the requirements of the EIR for the MBTA. The Board wishes to thank the Executive Office of Environmental Affairs for their hospitality in providing us with this opportunity to comment.

Sincerely,

Paula O. Skog

Paula O. Skog, Chairman
Westborough Board of Selectmen

CC/nb

cc: Town of Ashland, Paul D. Sharon
Town of Ashland, Board of Selectmen
Town of Southborough, Janice Conlin
Town of Southborough, Board of Selectmen
Town of Millbury, Earle W. Chase, Jr.
Town of Millbury, Board of Selectmen
Town of Framingham, Peter Noonan
Town of Framingham, Board of Selectmen
City of Worcester, Jordan Levy, Mayor & Councilor
City of Worcester, Stephen F. O'Neil
John J. Haley, Jr., MBTA General Manager

As a life long (56 Yrs) resident of Westboro, I feel I have to write, to request that a E. (environmental) I (impact) R (report be made <u>before</u> the MBTA project is implemented in Westboro.

Clement E Hitchings
43 High St. Ex
Westboro Ma.
0158.

RECEIVED
SEP 8 1992
MEPA

JD

RECEIVED
SEP 11 1992
MEPA

21 Maynard St.
Westboro, MA. 01581

September 8, 1992

Ms. Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge St. - 20th Floor
Boston, MA. 02202
Attn: MEPA Unit - Project 9154

Dear Secretary Tierney:

We are responding to the request for comments on the MBTA Worcester Commuter Rail Extension Project, EOEA project #9154. My wife and I are Westborough residents who live near the proposed Smith Valve Parkway site. We have concerns that we'd like to bring to your attention about this particular site.

Our primary concern is an increase in traffic on the streets in our neighborhood. Contrary to the MBTA statement in their ENF that "No significant environmental impacts are anticipated and access through a residential subdivision is not required..", we believe there certainly will be traffic impacts on the local roads and traffic will travel through residential areas, if not specifically residential subdivisions.

The attached map shows that of the six possible ways to get to the proposed site, five are by narrow, winding residential roads. Maynard St. and Mill Rd. do not have sidewalks and Fisher St. has very poor sidewalks for only part of its length and on the south side only. Our children must walk to and from the schools shown on the map along these roads, they must cross Fisher St. to get to these schools and we are very concerned for their safety, particularly with commuters on the roads trying to get to their trains on time.

The MBTA expects trains to run from 6 to 9 am, just the time that school children will be on these streets.

The MBTA believes that the majority of the traffic will take route 9 to Otis St. and avoid the roads we've mentioned. But local drivers know the Route 9 / Otis St. intersection is slow when making left turns and is backed up at rush hours. We believe the tendency will be for drivers coming from Westborough, Upton, Hopkinton and even parts of Northborough to take the narrow residential back roads to avoid this bottleneck.

The MBTA is forecasting over 600 cars plus some 150 "drop-offs" for the Smith Valve Parkway site. This is a total of 900 car trips in the morning and 900 in the evening. With a good part of these trips coming from the towns mentioned above and using the narrow residential back roads, there is indeed an environmental impact on our neighborhood and an impact on the safety and well being of all the children walking to the area schools.

We would also like to bring to your attention the proximity of this site to wetlands, to Blue Heron nesting areas, to archaeologically important areas, and to a Super Fund toxic waste clean-up site.

We believe the Smith Valve site is wholly inappropriate for such a major, high use station. We do support locating a regional station in Westborough with access from Route 495 and the Mass. Turnpike only.

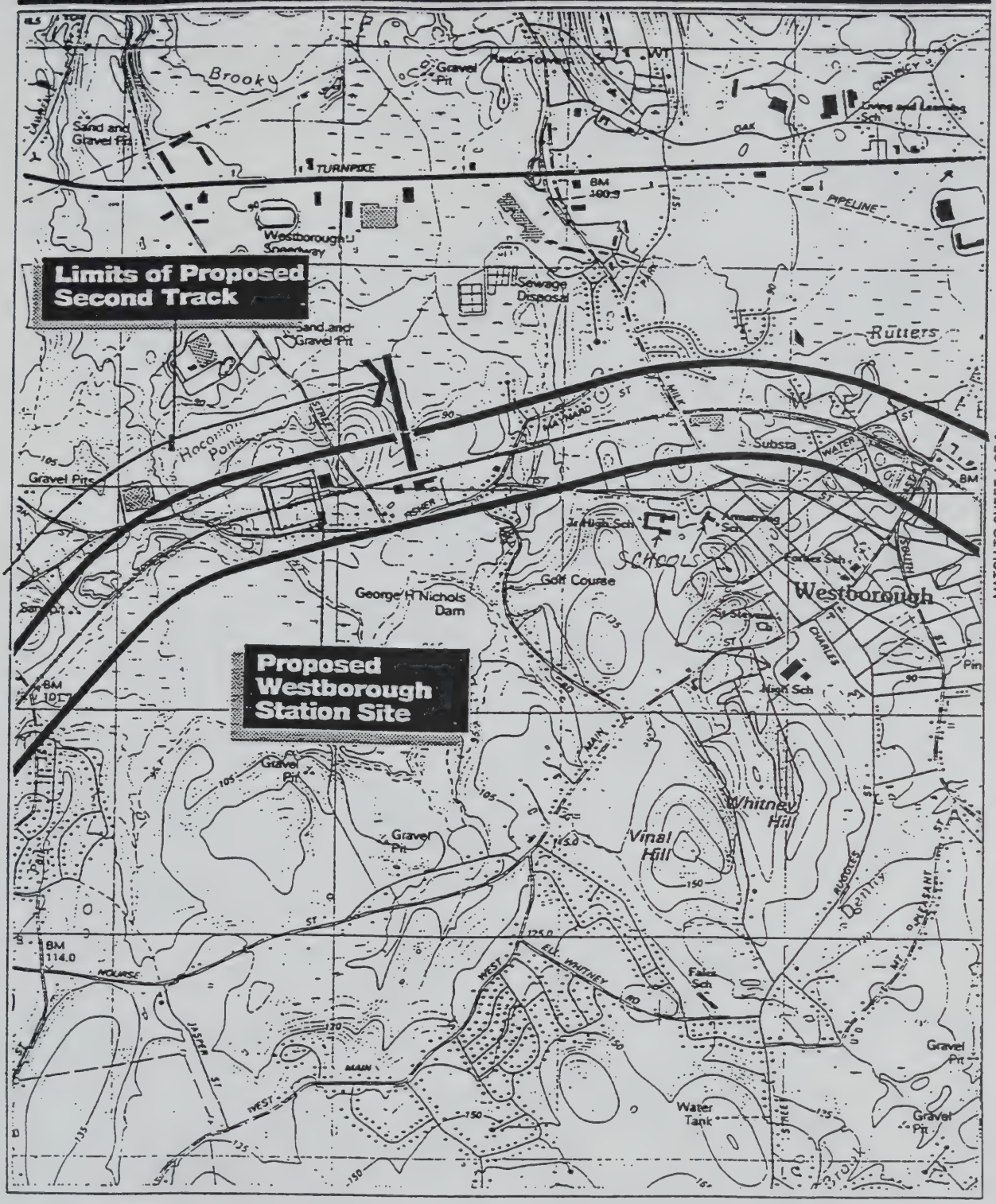
We urge you to require the MBTA to provide a complete EIR that will consider the factors mentioned above. We believe that a thorough environmental study will show that the MBTA has mis-represented the true impact of a station located at Smith Valve Parkway and we urge that, at the conclusion of such a study, this site be rejected.

Sincerely,

William Panas Helen Panas

William Panas Helen Panas

cc: MBTA
Senator M. J. Amorello



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000 Feet

0 2000

Source: USGS
Marlborough, Milford Quadrangles

Project Location

Sheet 5 of 8

Prepared By:

EDWARDS AND KELCEY, INC.
Boston, Massachusetts

Sept. 18, 1992

JD

RECEIVED
SEP 21 1992
MEPA

Ms. Susan F. Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

Attn: M.E.P.A. Unit

Dear Madam Secretary:

It became crystal clear to all those in attendance at the M.E.P.A. sponsored Public Hearing for Public Comment upon the proposed M.B.T.A. rail station location in Westborough, MA, that the project is a "major and complicated" one.

It is respectfully requested and strongly urged that EOEA/MEPA so designate the project.

May we commend this important "quality of life" issue to your immediate and favorable review.

Yours truly,

R. Lister

Robert G. Lister

10 West Street
Westborough, MA 01581-2515

Sept. 4, 1992

RECEIVED
SEP 8 1992
MEPA

Ms. Susan Tierney, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

Attn: M.E.P.A. Unit

Dear Madam Secretary:

As a Westborough resident for the past 28 years, I am deeply concerned for the future of our community and the quality of life its citizens may enjoy in the coming 21 Century.

The proposed construction of an M.B.T.A. station in our community carries far reaching environmental and financial consequences, consequences which may mortgage the lives of my grandchildren. Mortgaging my grandchildren's lives is not one of my life goals.

Facts alone should determine the build/no build decision.

Please be certain to initiate/complete an E.I.R. upon the proposed station site.

Thank you for your immediate attention to this most important matter and this request.

Very truly yours,

R. Lister

Robert O. Lister, Jr.

10 West Street
Westborough, MA 01581-2515

Joseph Orlando
5 Meadow Rd.
Westboro, Mass 01581

RECEIVED
SEP 8 1992
MEPA

Sept. 3, 1992

Dear sir:

I am against your E.N.F., because it does not cover all of the people's concerns. I believe that the MBTA will have a great affect on Westboro neighborhood. We will have a greater amount of noise pollution, and the small streets will be overcrowded, as these roads are very narrow. None of these roads have sidewalks, which puts the children in great danger.

I believe that you should have a Environmental Impact Report, which will give a more true picture of the overall problem.

Thank you
Joe Orlando

16 Fisher St
Westborough, MA 01581
Sept. 3, 1992

Susan F. Tierney,
Secty of Env. Affairs
100 Cambridge St.
Boston, MA 02202

RECEIVED
SEP 8 1992
MEPA

Attn: MEPA Unit

years ago, the Middle School, then the High School was built in "my" back yard so I have been very much aware of the increasing traffic, noise and dangers on Fisher Street. It is dangerous now backing out of my driveway onto Fisher St.

With the M.B.T.A. locating a station on Smith Valve Parkway, traffic will increase dangerously as people use Fisher St., Mill Road and Maynard St to get to Otis St. rather than route 9.

Sidewalks are either not there (Mill Road - Maynard St) or inadequate. Children are in danger not only going to or from schools

but also to play ground areas.

Traffic going to Otis St., Astra Pharmaceutical, Stop & Shop, Sam's, BJ's on Route 9 is unbearable now - we can't stand a greater load going to an MBTA station there. An EIR should be done before any decision is made.

Sincerely,

Donald Marshall

RECEIVED
SEP 8 1992
MEPA

41 O'Neil Drive
Westborough, Mass.
01581
September 5th, 1992

Dear Secretary Tierney;

As a resident of Westborough, I am request that an environmental Impact report be conducted for the MBTA project. Our natural resources and quality of space are something that can never be regained once taken, and that every aspect of environmental regard should be taken. I have some serious concerns how business is conducted in your department after reading about the early approval of the rail freight transfer terminal at Fort Devins. An E.I.R. is a must for the MBTA project in Westborough or any town in the state.

Very Concerned,

Diane S. McElveny

RECEIVED
SEP 9 1992
MEPA

Secretary
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
Attn: MEPA Unit

99 Fisher St.
Westboro, MA 01581
September 8, 1992

Dear Secretary:

I am writing in regard to the MBTA extension to Worcester and in particular to the siting of an MBTA station on Smith Valve and Otis St. in Westboro. The project is EOEA number 9154. I believe that an Environmental Impact Report (EIR) should be conducted due to the size of the project and the proximity to residential areas. The Otis Street site will create traffic, noise and lighting pollution on surrounding areas, which are primarily residential in nature. Also, the Otis Street site has many unique environmental issues that warrant critical review, they are:

- The Otis Street site is adjacent to the Hoccomocco Pond Super Fund site. This is a federally funded project to clean creosote from within and around the pond.

- There are piles of 55-gallon drums (approximately 20 drums) located on the proposed MBTA Otis Street site, indicating that the site may possess hazardous material. In fact, at one of the Westboro Selectmen's meeting on the MBTA siting, a person affiliated with Smith Valve (the previous or current owner of the property) admitted that there is hazardous waste on the site.

- The tracks are adjacent to high power lines. People waiting for the train would be almost directly under the power lines. Also, they would also be exposed to severe noise caused by the other trains which use these tracks.

An EIR is required to fully assess the viability of the Otis Street Site.

Sincerely,

Louis Jankauskas

Louis Jankauskas

10: MBTA

145 Upton Road •Westborough, Massachusetts 01581

September 10, 1992

RECEIVED
SEP 1 4 1992
MEPA

Secretary Susan F. Tierney
Department of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

MEPA: ENF for MBTA Worcester Commuter Rail Extension Project

Dear Secretary Tierney:

I am particularly concerned about the environmental impacts on the town of Westborough from the proposed expansion of commuter rail to Worcester. I respectfully request that you require the MBTA to file an EIR and proceed with a full MEPA review, considering the longterm and significant impacts of this project. As part of their expanded EIR, I would like the MBTA to address the following issues:

Regional Impacts: The construction of a regional station on Route I495, at the crossroads of major highways, must be addressed <u>before</u> the impact of any other site can be determined. This regional station would ideally be built on the highway with limited access (not in the Fruit Street area) and with minimal impact on country roads and residential neighborhoods,

In its ENF, the MBTA indicated that one of its goals is a regional commuter rail station at Route I-495, but that they are deferring the decision to build such a station. The decision whether to build a regional station must be made first; it will be impossible for the MBTA to make assumptions about the project's impacts without this information.

If the decision is to build a regional station, then the need for this station must be quantified, and the site for a regional station and its impacts should be part of the EIR for the Worcester Commuter Rail Extension Project.

If a regional station is built, the scale of any impacts of a local station in Westborough or Southborough would be very different than those indicated in the ENF. Without this regional station, the local stations would by default serve the regional demand, and the impacts on the towns would be magnified.

In addition, any long-term transportation plans for the Central Massachusetts/Metrowest areas will be affected by this commuter rail

project. Therefore, the future planning of the Massachusetts Highway Department, the Massachusetts Turnpike Authority, as well as regional traffic task forces should be coordinated with this project.

Traffic

There should be an updated demand analysis and traffic impact analysis considering a regional station and the proposed selected local sites. Many of the station locations listed in the ENF were not previously identified and were not included in the traffic evaluation based on the 1990 Feasibility Study.

The impacts on the intersections of Fisher and Otis Streets, Smith Valve Parkway and Otis Street, and Route 9 and Otis Street due to increased traffic will be considerable. The Otis Street/Route 9 intersection is at level F during peak traffic hours. The EIR should address the impact and possible mitigations of increased commuter traffic at this intersection.

Residents are concerned that the narrow, winding roads of Arch, Gleason Fisher, Maynard Streets, and Mill Road will be used as access roads by out-of-town commuters who hope to avoid the Otis Street intersection. An EIR should address the impact of increased traffic on access roads, particularly in residential neighborhoods, and recommend mitigation measures.

Ridership Analysis

Based on the Stone and Webster projections made in more prosperous times, about 100 riders from Westborough are projected for the near future, and 210 riders in 2010. Any MBTA station and parking lot on Smith Valve Parkway should be a local station; parking for three times the number of commuters puts undue stress on the Town's infrastructure of roads and on the services of Westborough Police and Fire Departments.

Pedestrian Safety

Pedestrian access to the Smith Valve site must be addressed, including sidewalks from intersections of Route 9 and Otis Street, plus pedestrian bridges, ramps, stairways under or over the tracks .

Fencing is an important safety factor, especially between the tracks to block pedestrians' crossing the tracks to reach the opposite platform..Fencing also should be installed along the back of Fisher Street to prevent pedestrian access to the tracks.

A middle school is located on Fisher Street, and many of the neighborhood schoolchildren walk to school . Assuring their safety is crucial, particularly in light of the increased traffic anticipated on winding,

narrow roads like Maynard and Mill Streets. The EIR should address pedestrian safety measures, such as sidewalks.

Many residential neighborhoods are crossed by the rail line, and.the safety and aesthetic features of any fencing installed, as described in the ENF, must be worked out with the abutters.

Noise Pollution

More noise is generated by higher track speeds, as well as by the starting and stopping of more frequent trains. Where there is no natural barrier between the tracks and residences, sound barriers should be installed along the right of way The noise levels anticipated should be analyzed by the EIR, and their impact on residential areas addressed.

Water Concerns

Less than 500' from the proposed Smith Valve site. is Lake Hoccomocco, a designated Superfund Clean-up site. The EIR should address any possible leaching of contaminants across Smith Valve Parkway. In the vicinity is also the town well on Otis Street, and any impacts on this well should be explored.

The SUASCO floodplain lies to the south of the Smith Valve site. The EIR should address how the increased noise and air pollution of the trains will affect the diverse wildlife in the area, particularly the Blue Heron rookery.

Recreational Areas:

The Smith Valve site includes a baseball field that is used for recreation by Westborough residents. This ballfield will be destroyed by the MBTA station, and provision for its replacement should be considered.

Archaeological Site

The nearby Charlestown Meadows is the site of an extensive archaeological study on the habitat of native Americans who hunted and fished in this area near Lake Hoccomocco and Assabet headwaters. The EIR should address the preservation of any archaeological artifacts at the Smith Valve Parkway site.

In light of the above mentioned concerns, I request that an Environmental Impact Review be conducted for the Smith Valve Parkway site, as well as for a regional station on Route 495.

Sincerely,

Kristina N. Allen

Kristina N. Allen

Memo From:

C. H. KELLIHER

JD

RECEIVED
SEP 10 1992
MEPA

Ms. Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, Mass. 02202
attn: MEPA Unit

Dear Ms. Tierney,

I have read the MBTA's Environmental Notification Form and wish to inform you that I am opposed to the proposed Smith Valve Property site for the following reasons:

1) The report does not address upgrade the old bridges, Arch Street, Maynard Street, Water Street and East Main Street.

2) The site of Smith Valve has been known to contain Hazardous Waste Disposal per our Board of Health Director and is also adjacent to a Major Federal Hazardous Waste Site Cleanup.

3) The report fails to mention the Otis Street Well which is within the one half mile radius.

4) The report fails to address the fisheries and wildlife in the Suasco Water Shed and the Blue Herons and Wild Geese that live there.

5) The traffic that will be generated at the proposed station through four local winding [illegible] The schools have not been addressed

Ms. Tierney, we should have a regional site in the Route 495 area that will have little impact on an infrastructure that is presently busy. Also, the MBTA should be required to do an E.I.R. Report as any business would be required.

Let us not shirk our duties by putting this project on a Fast Track.

Sincerely
Charles H. Kelliher
Town of Westborough
Selectman

RECEIVED
SEP 10 1992
MEPA

21 Old Colony Drive
Westborough, MA 01581
September 9 1992

Ms. Susan F. Tierney
Secretary of Environmental Affairs
Commonwealth of Massachusetts
100 Cambridge Street
20th Floor
Boston, Massachusetts 02202

Attention: MEPA Unit

Dear Ms. Tierney:

We would like to formally request that an Environmental Impact Report be required for the Worcester Commuter Rail Extension Project in Westborough.

In addition to the environmental issues usually covered, such as water pollution, etc., we would ask that you ensure that issues such as regional planning, traffic impact, pedestrian safety, noise and light pollution, etc., be addressed.

Thank you very much in advance for your consideration of this request.

Sincerely,

Barbara R. M. Brais

Robert L. Brais

JD

Ms. Susan Tierney
100 Cambridge Street
Boston, MA. 02202

RECEIVED
SEP 10 1992
MEPA

September 6, 1992

Dear Ms. Tierney,

This letter is in reference to the proposal of the MBTA to construct a commuter rail station at Smith Valve Parkway in Westboro, MA. My husband and I both feel that an Environmental Impact Report is ESSENTIAL before such a decision is made.

We have been residents of this town for 15 years and live in the general area of the proposal. This particular section of town has undergone rapid changes in construction and industry over the years and our concern is the traffic impact, pedestrian safety, and the ensuing pollution that will be inevitable if this station is constructed Otis Street, in particular, which runs perpendicular to Smith Valve Parkway has undergone massive transformation with the huge development of Astra Pharmaceutical Headquarters, many small businesses, and recently a back entrance for Stop and Shop Plaza and Sam's Wholesale Club. The traffic patterns have relected this and one can hardly enter or exit the street now without lines of traffic in both directions. The surrounding streets, i.e. Fisher, Maynard, Mill, the Arch Street development, and the new low income housing development on Gleason Street that is being built cannot handle these volumes of traffic now as the roads are small, winding, and have no sidewalks. Many children use these streets to walk to school everyday.

The construction of this station deserves an EIR study before any more steps are considered. Please require that the MBTA conduct this study. There are too many existing issues and problems as well as concerned citizens in this town to submit a recommendation without this report.

Sincerely,

Jan & Andy Girard

Jan and Andy Girard

RECEIVED
AUG 31 1992
MEPA

August 27, 1992

Ms. Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202
Attention: MEPA Unit

Dear Secretary Tierney,

This letter is in response to your request for public comment on the Worcester Commuter Rail Extension Project.

As a Westborough resident and a member of Westborough's MBTA Advisory Committee, I have been actively involved with the proposed expansion of commuter rail to Worcester since June of 1991.

While I am a supporter of commuter rail, I am also concerned about the impact on the town of Westborough and all of the other towns that have been selected for MBTA stations.

I respectfully request that the MBTA be required to file an EIR and to follow the full MEPA review process. In addition to the analysis already agreed to by the MBTA in their recently filed ENF, I also request that the MBTA be required to address the following additional topics as part of an expanded EIR:

1.0 Regional Impacts

1.1 Regional Site Selection - As stated in the ENF, one of the goals of the MBTA is to provide a regional station at Rt. 495. To date, the MBTA has only committed to studying a Rt. 495 site, not building one.

This position presents a problem for the Towns of Westborough and Southborough. If a regional station is not built, then the local stations in these towns will become de-facto regional stations and the corresponding impacts will be different than what is currently projected by the MBTA. If a regional station is built, then this will again have a different impact on the towns.

Using this logic, I think it can be successfully argued that it is impossible for the MBTA to make assumptions regarding the impact of this project without first making a decision on building a regional site at Rt. 495. If this decision is made positively, then the MBTA should be required to include the impact of a regional site in the EIR so that impact of both regional and local sites can be assessed at the same time.

EIR Topic: To quantify the need for a regional site. If a regional site is needed, include regional site locations and impacts as part of the EIR for this project.

1.2 Traffic - Some of the assumptions made in the ENF are based on information taken from the Commuter Rail Extension Feasibility Study published in January 1990. It should be noted that 4 of the 5 intermediate local sites named by the MBTA were not identified as "preferred station locations" and therefore were not included in the traffic evaluation section.

EIR Topic: Provide an updated demand analysis and corresponding traffic impact analysis using the proposed local (and regional) sites.

1.3 Co-Ordination With Other Agencies - Regional groups like the MetroWest Transportation Task Force and Central Massachusetts Regional Planning Commission, along with the Massachusetts Highway Department and the Massachusetts Turnpike Authority all have long term transportation plans for the MetroWest area. The ENF does not address how this project would fit in with these long term plans.

EIR Topic: Analysis of how the MBTA commuter rail expansion will fit in with the plans of the regional groups or agencies that have long term transportation plans. Specifically, how would the proposed MBTA stations fit in with plans for a new exit on Rt. 495 at the Southborough/Marlborough border?

2.0 Town Impacts

2.1 Safety - The proposed route for the commuter rail extension has several miles of track that passes through many residential neighborhoods. While the ENF mentions the installation of chain link fencing along the entire route, many residents have already installed fences to prevent access to the tracks from their property.

EIR Topic: Include a detailed analysis of existing residential neighborhoods and stipulate that the MBTA must work with abutters in providing aesthetically acceptable fencing solutions.

2.2 Noise - The ENF states that commuter trains are quieter than the existing freight trains. This may be true at current speeds, however, with the addition of new signals and the planned track improvements, both the freight and commuter trains will be traveling at higher speeds and therefore creating more noise.

EIR Topic: Include an impact analysis on residential neighborhoods for ALL train traffic that addresses the noise increase which will result from higher track speeds and also from commuter trains starting/stopping at the proposed commuter rail stations.

3.0 Westborough Site Specific Impacts

3.1 Traffic - As stated in the ENF, the MBTA is assuming that the major access to the Smith Valve station will be via Otis St. The Route 9/Otis Street intersection is currently at a service level of "F" during rush hours. Many Westborough residents are concerned that out-of-town traffic will use local roads to bypass this intersection and enter the site through residential neighborhoods.

EIR Topic: Address the traffic impact on all access roads to the site and recommend mitigation measures.

3.2 Pedestrian Safety - The ENF does not address pedestrian access other than conforming with the Americans with Disabilities Act.

EIR Topic: All aspects of pedestrian access should be considered including sidewalks, cross track pedestrian bridges and fencing to prevent unauthorized access to tracks by commuters.

3.3 Light Pollution - The ENF does not specify any guidelines for lighting design.

EIR Topic: Address any adverse affects of station site lighting.

I look forward to working with you and your department over the next few years. Through continued community input, we can take a good project and make it better for everyone involved.

If you have any questions on any of the above recommendations, please feel free to call me at my office number 508-870-1715 or my home number 508-366-1172.

Sincerely,

Lawrence J. Gomes
10 Old Flanders Road
Westboro, MA 01581

cc: Ashland Board of Selectmen
Ashland Conservation Commission
Ashland Planning Board
Central Mass. Regional Planning Commission
City of Marlborough, Attn: Mr. Michael Hogan, Mayor
Framingham Conservation Commission
Framingham Planning Board
Grafton Board of Selectmen
Grafton Conservation Commission
Grafton Planning Board
Millbury Board of Selectmen
Millbury Conservation Commission
Millbury Planning Board
Representative John R. Driscoll
Representative Barbara Gardner
Senator Matthew J. Amorello
Southborough Board of Selectmen
Southborough Conservation Commission
Southborough Planning Board
Sudbury Valley Trustees
Westborough Board of Selectmen
Westborough Conservation Commission
Westborough MBTA Advisory Committee
Westborough Planning Board

3 Cottage St.
Southboro, Ma
01772

Sept 14, 1992
(date)

RECEIVED
SEP 15 1992
MEPA

Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge Street, 20th floor
Boston, MA 02202

Attention: MEPA Unit

Dear Secretary Tierney:

I am much concerned about the proposed MBTA station in (Cordaville) Southborough. As you probably know this would be on the site of the surrounding area of the former Cordaville Woolen Mill. There were dyes and waste dumped, buried & put into the Sudbury River there. I live very near the site and am worried about the unearthing of this ban and covering up whatever. I hope your department will take a special interest in the project before it gets off the ground. Also am concerned about extra traffic and exhaust fumes in a small concentrated area. I'm all for public transportation but hopefully it can be established to help many and not put others at more risk than we are already.

Thanking you.

Sincerely,
Arline Williams
3 Cottage St
Southboro, Ma. 01772.

RECEIVED
SEP 9 1992
MEPA

BRIDGEWATER STATE COLLEGE
Bridgewater, Massachusetts 02325

September 4, 1992

Secretary Susan F. Tierney
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston MA 02202

ATTN: MEPA Unit
RE: Archaeological Survey of the Proposed MBTA Station, Westborough, MA

Dear Secretary Tierney:

As archaeological consultant to the town of Westborough, I have been aware for some time of the proposal to construct an MBTA station in the town. I have commented to the Westborough Planning Board in the past on the various alternatives and the degree of potential adverse impact to cultural resources each of these would have. I now understand that a final site selection has been made for the Otis Street location.

In my original letter to the Planning Board, I indicated that this location had the highest potential of any of the options for impacting important cultural resources. The area around Hoccomonco Pond is well known for its prehistoric sites; I personally know of 16 sites within a 1/2 mile radius of the proposed location, including some which would doubtless be eligible for inclusion in the National Register of Historic Places. These sites span the entire prehistoric sequence in Massachusetts, from Paleo-Indian to Contact. In particular, two sites on the southern side of Hoccomonco Pond, Hoccomonco #s 1 and 2, appear to represent single-component loci of the Middle Archaic and Middle Woodland phases, respectively. The excavator of these, Mr. Raymond LeMire, did not extend his pits south of the current Smith Valve Parkway, but there is every reason to expect that one or both of these sites could have extended in that direction into the parcel where the proposed station will be built. In addition, it is entirely possible that additional, as yet unidentified sites will be found in that area.

Because Conrail/Amtrak is partially a public agency funded by the Federal Government, the procedures outlined in Section 106 of the National Historic Preservation Act of 1966 would appear to apply. These require the agency to undertake at its expense archaeological investigations to determine the presence of National Register eligible properties in the project area, and to take appropriate steps to mitigate adverse impact to such properties if they are identified. In addition, the amount of money expended on the project and the project area would appear to be sufficient to trigger a full M.E.P.A. review.

I would urge your office to work with the Massachusetts Historical Commission to require an archaeological intensive survey throughout the property. I would also request that a full E.I.R., including estimation of archaeological impact, be conducted on this property as soon as possible.

Very truly yours,

Dr. Curtiss Hoffman
Department of Sociology
and Anthropology

cc: MHC, Westborough Planning Board, Westborough Conservation Commission, Westborough Historical Commission, Westborough Board of Selectmen

JD

Alden W. Jefts
Municipal Consultant

RECEIVED
SEP 22 1992
MEPA

P. O. Box 766
Westborough, MA 01581
(508) 366-7518

September 21. 1992

Susan F. Tiernay
Secretary of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, Massachusetts 02202

Attn: MEPA UNIT

Re: Westborough as an M.B.T.A. Station Site

Dear Ms. Tiernay:

In my 26 years residency here in Westborough, I have served as a Selectman, Planning Board member and chairman, vice chairman of Central Mass. Regional Planning Commission, Board of Appeals member and now as Grant Consultant to the Town.

Projects such as the location of an M.B.T.A. station here have been before us over the years and have always warranted a full Environmental Impact Report study being done. I want to see that same process followed on this project. Right now, it appears that the proponents feel they will placate us by down-sizing the parking lot from 600 to 400 car capacity. That is not going to solve our problem - the Smith Valve parking location is just not right - a full EIR will show that.

If the M.B.T.A. got their act together and did the job right, a Route 495 location would be started through the process.

Just because the Smith Valve location is a "quick and dirty" stop location doesn't make it right or fair to our Town.

Riders from Northborough, Shrewsbury, Millbury, Grafton and other communities, who may elect to use a Westborough area stop rather than drive further, will have to use streets which in most cases are narrow and winding - which already feed auto traffic to Sam's Club, Healthco, Astra and Bose and a variety of smaller businesses. Truck traffic to the Marriott Distribution Center, Sam's, Astra, Healthco and others, auto traffic which will generate from the new affordable housing complex approved for Fisher/Gleason Streets.

We in Westborough do not have the funds to upgrade these roads nor handle the increased public safety problems which are bound to surface.

I urge you to see that this project is handled right with a full study, and am certain that a location accessible from Route 495 will emerge as the proper site to serve the most citizens.

We can wait for a local stop until the 495 station is built.

Yours truly,

Alden W. Jefts

September 25, 1992

Secretary Susan B. Tierney
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, MA 02202

RECEIVED
SEP 28 1992
MEPA

Dear Ms. Tierney;

This letter is intended as a response to an MBTA train station being recommended for Smith Valve Parkway in Westboro. We strongly oppose construction of this station.

We have been residents of this neighborhood for over 9 years. During this time, we have experienced the negative impact of retail, warehouse and business development on Fisher and Otis Streets, Smith Valve Parkway and Route 9. In addition to increased traffic, there is a definite increase in associated noise and air pollution. The proposed station will only add to the burden already placed upon this once-quiet neighborhood.

In addition, we are concerned about other aspects of the station:

- many neighborhood roads are unable to safely handle increased traffic patterns
- there will be an increase in noise pollution
- there will be an increase in air pollution from idling trains
- this area is not convenient to Routes 90, 290 and 495 in comparison to placing the station on the Route 9/495 area
- possible vagrancy of train passengers
- close proximity of the station to the environmentally sensitive Hoccomocco Pond areas
- the Westboro station is very close to the proposed Grafton station and we question the need to have 2 stations within 2 miles of each other

It is our sincere hope that this station is not placed in the Smith Valve area of Westboro. If a station is necessary in Westboro, we feel that the Route 9/495 area makes more sense with regard to convenience and potential impact on the surrounding areas.

Thank you for consideration in this matter.

Sincerely,

Cheryl + Paul Crivello

Cheryl and Paul Crivello
79 Fisher Street
Westboro, MA 01581

cc: Joline Dubner, MEPA
MBTA Authority
Westboro Board of Selectman

June 26, 1992

Ms. Paula Skog, Chairman
Board of Selectmen
Town of Westborough
Town Hall - 34 West Main St.
Westborough, MA 01581

Dear Chairman Skog:

Attached is a Citizen's Petition concerning the siting of a proposed MBTA Station in the Town of Westborough.

Please note the signatures enclosed include members from across the entire Westborough community.

In addition to Westborough residents, our interest group has grown to include business owners and workers within Westborough who reside in surrounding communities and are very familiar with our Town's infrastructure.

The petition drive is continuing and hopes to be of constructive assistance in the planned growth, development, and needs of Westborough.

Yours truly,

Judith K. McCabe

Judith K. McCabe
15 Maynard St.
Westborough, MA 01581

cc: Mr. Richard Taylor
Secretary of Transportation

— Larry Parrette'

Petition

We, the undersigned, are opposed to the selection of Smith Valve Parkway as a site for the proposed MBTA Station.

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Access to an MBTA Station would better serve all surrounding communities, increase ridership for the MBTA and <u>not</u> impact the insufficient roadways of our rural towns, if located directly off major routes, i.e. Rte 495 and/or Rte 90.

Name:	Address:
Betty Urquhart	11 Maynard St Westboro
Leon G. Urquhart	11 Maynard St Westboro
[illegible]	5 Maynard St Westboro
Thomas [illegible]	34 Water St Westboro
Carmen Whitney	120 Milk St Westboro
Joseph Lacione	24 Maynard St. Westboro
Betty Pults	27 Maynard St Westboro
Florence H. Fulose	1 Oldham Rd. Westboro, Mass
Elizabeth P. Carter	1 Lyman St Westboro, Mass.
Frederick Hulbert	63 W Main St. Westboro Ma
Helen G. Cheney	6 Juniper C. Westboro Ma.
[illegible]	75. Milk St Westboro
[illegible]	5 CENTRAL ST WESTBORO
R. L. Wood	36 Maynard St Westboro
[illegible]	37 Maynard St Westboro
[illegible]	37 Maynard St Westboro Ma.
[illegible]	24 Maynard St. Westboro
Frannette Porter	30 MAYNARD ST WESTBORO
[illegible]	18 Maynard St. Westboro
[illegible]	10 Maynard St Westborough

Petition

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Name:	Address:
[illegible]	7 Meadow Rd - Westboro
Ada Orlando	5 Meadow Rd - Westboro
Vivian Ardmiers	7 Meadow Rd - Westboro
Margaret Barry	2 Fairview Rd - Westboro
Beverly Shaughnessy	4 Fairview Rd. Westboro
Leah Pogrow	7 Fairview Rd Westboro
Walter Pinson	7 Fairview Rd Westboro
Betsy Raymond	8 Fairview Rd Westboro
[illegible]	11 Fairview Rd - Westboro
Richard X. Francis	14 Fairview Rd Westboro
DAISY WONG	17 FAIRVIEW RD
Louise Tyler	10 [illegible]
Mr & Mrs [illegible]	18 Fairview Rd
Mr/Mrs Leslie Nadeski	152 MILK ST
Carla Nadeski	152 Milk St.
[illegible]	156 Milk St
Frank Orlando	5 Meadow Rd
[illegible] Orlando Jr	21 Blake St
[illegible]	15 [illegible]
[illegible]	20 [illegible] St

Petition

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Name:	Address:
Paul McNulty	22 SPRING RD, WESTBOROUGH.
William J. Adrian	30 E. Main St. Westborough
[illegible]	38 Fisher St
Pendleton C. Temple	36 West St. Westborough
[illegible]	4 Ruggles Road Rd Westboro
Jean McCabe	15 Maynard St Westboro
DEAN BOAFO	26A Morse St. WESTBORO
[illegible]	26th Morse St. Westboro
Heraldine E. Dodd	23 Maynard ST Westboro
Paula M. Hackell	4 Mohawk Circle Westboro
Bill Panas	21 Maynard ST. Westboro
[illegible]	21 MAYNARD ST WESTBORO
[illegible]	60 Mill Rd "
[illegible]	1 Cendrelos
[illegible]	19 Heath St Westboro
[illegible]	1 [illegible] ST Westboro
[illegible]	[illegible] "
[illegible]	21 [illegible] "
[illegible]	1 Andrews St "
[illegible]	[illegible] "

Petition

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Name:	Address:
Jean M. Petralia	72 Fisher St. Westboro
Jacqueline Orlando	35 Warren St. "
Romilda Orlando	35 Warren St "
Rita Orlando	35 Warren St "
Melissa Orlando	35A Warren St. "
Michele Malkits	49 Brigham St. "
Beverly Boyer	2 Fisher St. "
Carol E. Acusky	9 Old House St. "
Linda M. Brown	18 Smith St. "
Priscilla Harvey	12 Maple Avenue "
Betsy M. Silvester	29 Treetop Pk. "
Betty A. Silvester	7 Franklin Avenue "
Christopher Petralia	72 FISHER STREET - WESTBORO MA.
James M. Orlando	70 Adams St "
Donald Coleman	30 Warren St Westboro
Marsha Orlando	70 Adams St. "
Ruth Cooper	7 Lincoln ST "
Manford E. Cooper	7 Lincoln St "
Willi Orlando	35A Warren St. "

Petition

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Name:	Address:
Gordon Coil	17 Chauncy Circle

Petition

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Name:	Address:	
Fred DeWolfe	5 Glen St.	Westboro
Martha Harrison	7 Glen St	Westboro
[illegible]	11 Glen St.	Westboro
[illegible]	15 Glen St	Westboro
[illegible]	18 Glen St	Westboro
Maureen Dressler	15 Glen St	"
[illegible]	17 Glen St	Westboro
[illegible]	17 [illegible]	Westboro
Kindrice Wheeler	31 Arch St.	"
Bernd Wheeler	31 Arch St	"
Peter Nazarian	29 Arch St	
[illegible]	32 Arch St.	Westboro
[illegible]	22 Arch St.	"
Robert M Fay Sr	22 "	"
[illegible]	23 ARCH ST.	WESTBORO
Mary Driscoll	21 Arch St	Westboro
[illegible]	17 Arch St	Westboro
[illegible]	15 Arch St	Westboro
[illegible]	9 Arch Street	Westboro
Ashley Beck	8 Arch Street	Westboro

Petition

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Name:	Address:		
George Bell	8 Arch St.,	Westborough	01581
Susan Stagg	27 Arch Street,	Westborough	01581
Arnold F. Santagay	27 Glen Street	Westborough	01581
[illegible]	28 Glen Street	Westborough	01581
Lytle S. Melvin	26 Glen Street	Westborough	01581
[illegible]	21 Glen St.	Westborough	01581
Donald E. Banks	31 GLEN ST	"	01581
[illegible] O Kahler	37 GLEN ST	"	01581
[illegible]	27 Arch St	Westborough	01581
Deborah Dennis	30 Arch St.	Westboro	01581
Brigitte Taulinger	42 Glen St.	Westboro	0581
M. Pamela Kapity	41 Arch St.	Westboro	01581
Darwin M. Kapity	"	"	"
Marianne Viscardi	37 Arch St.	Westboro	01581
Janet F. Allen	14 Arch St.	Westboro	01581
Bruce I. Allen	"	"	"
[illegible]	27 Glen	Westboro	01581
Marie H. Noyes	34 Arch St.	"	
[illegible]	25 Arch St	Westboro	01581

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Name:	Address:	
Marsha Weaver	7 Captain Forbush Rd.	Northborough
[illegible]	3 [illegible] Dr	"
Elizabeth Colbert	14 Maynard St.	"
[illegible]	14 Maynard St.	"
[illegible] Soule	63 Adams St.	"
[illegible] Travis	55 Church St.	"
Robert Peter Travis	55 Church ST.	"
[illegible]	37 Arch ST	"
Virginia T. Lemaire	16 Maynard St.	"
[illegible] K M. Cole	15 Maynard St	"

Petition

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Name:	Address:
Donald R Shepley	82 Fisher St
John F Malley	18 ANDREWS ST.
Helen M Merchant	28 Cross Street
Victor A. Baucricius	3 Birch Rd.
Anne Tullis	17 WHITNEY St.
[illegible]	11 Pierce Drive
Evelyn W. Tolles	11 Cortland Drive
Dorothea M. Tetreault	1 Robin Rd.

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Name:	Address:
Christine M. MacKenzie	37 Fisher St. Wbro 015
Dorothy P. Tinkham	37 Fisher St. "
Tammy L MacKenzie	37 Fisher St.
Sonja Bridges	30 Meadowbrook Rd Grafton 01519
Albert Ohrman	49 West St Westboro, Ma.
Emily Ohrman	10 West Main St Westboro
Elizabeth M. Ohrman	133 Milk St Westboro
Sheila McLeod	257 Turnpike Rd Westboro
Janet D. Arnold	10 Denfeld Drive Westboro
[illegible]	3 West Main St
[illegible]	134 [illegible]
Shawn A MacKenzie	66 South St. Westboro ma.
Andrea Linardi	30 Robin Rd Westboro, MA

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Name:	Address:
[illegible]	5 Maynard St. Westborough, Ma.
Chris Blair	247 Turnpike Rd Westboro, MA
Timothy Crocker	17 Lyons St. Westboro MA
[illegible]	55 Hopkinton Rd. Westboro Ma.
[illegible]	78 Fisher St. Westboro - MA.
Brenda Nikas Thigpen	78 Fisher St. Westboro
[illegible]	5 Maynard [illegible] W/Boro

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Name:	Address:
[illegible]	17 WHITNEY WESTBORO
[illegible]	40 Summer St. Westboro
[illegible]	40 Summer St Westboro
[illegible]	154 Lorad Road Marlboro
[illegible]	5 ARMSTRONG DR. WESTBORO
Bill Carrier	73 Nourse St. Westboro
[illegible]	1 Kelly Ln Westboro MA 01581
[illegible]	36 Summer St Westboro
Charles W Brone	21 South St. Apt. 33 Westboro
Paul Martin	18 Overlook Dr. Westboro
[illegible]	35 Robin Rd Westboro
Edward C Hadley	35 Robin Rd Westboro
[illegible]	112 Upton Rd. WESTBORO

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Name:	Address:
Joseph Jackson	11 Wheeler Rd N. Grafton
Joan Sharp	5, Cherry St N-Boro
[illegible]	1 [illegible] Turnpike Rd Westboro.

Petition

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Name:	Address:
Morris Lukey	38 Fisher St. Westboro
Helen Henderson	97 Fisher St. Westboro
Beryl Henderson	97 Fisher St "
Paul Jankauskas	99 Fisher St. Westboro
John GIRARD	100 Fisher ST Westboro
W Khinal	[illegible] Fisher St Westboro
Florence A. Connell	96 Fisher St Westboro
Barbara Perkins	8 Fisher St. Westboro
John A Perkins Jr	80 Fisher St. Westboro
Marlene A. Ronnquist	93 Fisher St. Westboro
Charles F Brown	91 Fisher Westboro
William Howland	97 Fisher St Westboro
[illegible] Russell	85 Fisher St. Westboro
Robert Russell	85 Fisher St. Westboro
Eric A. Cole	90 Fisher St Westboro
Mary Cole	90 Fisher St Westboro
Fred Macdonald	88 Fisher St Westboro
Ann Macari	88 Fisher St. Westboro
Marilyn J. Lallier	4 Mount Rd Westboro, MA

Petition

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Name:	Address:
Joseph Jackson	11 Wheeler Rd N. Grafton
Joan Sherp	5, Cherry St N-Boro
[illegible]	1 [illegible] Turnpike Rd Westboro.

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Name:	Address:
Morris Lukey	38 Fisher St. Westboro
Helen Fenlason	97 Fisher St. Westboro
Beryl Fenlason	97 Fisher St "
Paul Jastrzebski	99 Fisher St. Westboro
John Giard	100 Fisher St Westboro
[illegible]	[illegible] Fisher St Westboro
Florence A. Connell	96 Fisher St Westboro
Barbara Perkins	[illegible] Fisher St. Westboro
John A Perkins Jr	80 Fisher St. Westboro
Marlene A. Rosenquist	93 Fisher St. Westboro
Charles F Brown	91 Fisher Westboro
William Howland	97 Fisher St Westboro
[illegible]	85 Fisher St. Westboro
Robert Russell	85 Fisher St. Westboro
Eric A. Geller	90 Fisher St Westboro
Mary Geller	90 Fisher St Westboro
Lorna Mackenzie	88 Fisher St Westboro
Ann Marcati	88 Fisher St Westboro
Marilyn J. Lallier	4 Mount Rd Westboro, MA

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Name:	Address:	
Sandy Spinella	48 Valentine Rd	Northboro, Ma.
[illegible] Patterson	300A PROVIDENCE RD.	S. GRAFTON, MA
[illegible]	50-Y Commons Dr.	Shrewsbury, Ma
Sharon McDowell	110 Hudson ST.	NORTHBORO, MA.
[illegible]	19 ST. JAMES RD	SHREWSBURY, MA.
Sonia Rancia	11 Memorial DR.	NORTHBORO, MA
Ruth E. [illegible]	37 River St.	HUDSON MA.
[illegible]	154 Conrad Road	Marlboro Mt.
Sara Jordan	12 Clifford Rd	Southboro, MA
[illegible]	45 Sheridan Dr. Apt. 9	Shrewsbury, MA
Dian [illegible]	120 S MAIN ST	MILLBURY MA
Lisa [illegible]	37 Madison St	Auburn MA
Ray [illegible]	45 Brendr Dr.	Northbridge MA
Sarah Atlee	174 Pinehavendr.	Northboro, MA.
Mimi Fernandes	24 Prospect St	Worcester MA
Diana M. Giocca	261 Old Mill Rd	Shrewsbury, M
Elaine Sarrasin	74 Fanny Rd	Marlboro, Ma.
[illegible]	205 [illegible]	Quincy MA
[illegible]	[illegible] Dr.	Douglas MA
[illegible]	469 Old Westboro Rd	N. Grafton

Petition

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Name:	Address:
Jacqueline M Cox	11 Fisher St. Westboro
David M Cox	11 Fisher St Westborough
Robert P Sylvester	16 Gary Cir. Westboro
Robert Fmacdonald	8 Ward Ln Westboro
Joyce Banks	60 Bellamy St. Westboro
Paul Banks	60 Bellamy St Westboro
Deborah Walker	60 Bellamy St Westboro
James E Hayes	17 Maple Ave Westboro
James W Fitzpatrick	58 Rogers St. Westboro
David J Mychard	49 Summer St Westboro
[illegible]	88 Milk
Robert A Falvey	15 Brigham Westboro
Pat Thatcher	6 Ring St. Northboro
Paul Winchell	13 Summer St. Westboro
Helen VanDam	14 Forbes St. Westboro
John Van Dam	60 Summer St Westboro

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We, the undersigned, are opposed to the selection of Smith Valve Parkway as a site for the proposed MBTA Station.

The impact of increased traffic will have a detrimental effect on the narrow, winding roads of many old established neighborhoods, threatening the safety of our children as well as contributing to the already hazardous Rte 9 - Otis St. intersection.

Access to an MBTA Station would better serve all surrounding communities, increase ridership for the MBTA and not impact the insufficient roadways of our rural towns, if located directly off major routes, i.e. Rte 495 and/or Rte 90.

Name:	Address:
Carol E. Moore	12 West St. Westborough

Petition

We, the undersigned, are opposed to the selection of Smith Valve Parkway as a site for the proposed MBTA Station.

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Name:	Address:
[illegible]	34 [illegible] Rd The [illegible]
[illegible]	211 E Mount St Worcester
Cathy A. Deliardis	211 E MT ST. Worcester
[illegible]	24 [illegible] Line Trafton
Phyllis Zanda	158 Fairhaven Rd. Worcester
Nena Hyde Wall	81 Church St. Northboro

JD

September 24, 1992

Secretary Susan F. Tierney
Executive Office of Environmental Affairs
20th Floor
100 Cambridge St.
Boston, MA 02202

RECEIVED
SEP 28 1992
MEPA

Attention: MEPA Unit
EOEA # 9154

Dear Secretary Tierney,

I formally request that a full-scale Environmental Impact Report following the MEPA process be mandated for the "Worcester Commuter Rail Extension Project".

After attending the MEPA Scoping Session in Westborough on September 15, I was pleased to hear an EIR would be required of the Massachusetts Bay Transportation Authority (MBTA). Thank you for considering a needed "major and complicated" designation for this project.

The ENF filed on August 17, 1992 by the MBTA refers to the "Project" as "Statewide", yet omits the Worcester Terminus (to be filed separately "after the City of Worcester and the Worcester Regional Transit Authority agree on the development plans of Union Station").

Therefore, the impact on the five towns involved is monumental, especially with regard to traffic and safety, and does not achieve the stated proposed goal of the MBTA, which is to link metropolitan Worcester with Boston.

My husband and I are life-long residents of the Worcester area. For the past twenty years, we have owned and operated a business in the Town of Westborough and make it our home. We have raised a family here and are active in the community.

There is no reasonable road system connecting the majority of Westborough residents who would use the MBTA station and the presently proposed Otis Street site.

Although the ENF states that "access to Stations would not be through any subdivisions", the proposed 640 car Station site proposed in Westborough is accessible to Westborough residents mainly by travel over four narrow, winding, hilly residential neighborhood roads. On one of these streets (Fisher St.), there are two schools with an enrollment of 680 students encompassing grades 5 through 8, many of whom walk to and from school.

The "major route" access referred to by the MBTA is Route 9 and Otis Street. This intersection is a "Level of Service F" (Study completed in July 1991 by Central Planning), is already overburdened and continues to be more dangerous every day. It would be used primarily by commuters from Shrewsbury and Northborough. This and the 640 car size give rise to the proposition that the MBTA intends to make this a regional rather than local site, accessible mainly to Shrewsbury and Northborough traffic.

I have been following this "project" since it's inception and have been working with the Metro-West Transportation Task Force which also feel a regional station located on Route 495 and/or Route 90 (The Massachusetts Turnpike) is feasible. The inevitability of future development of the Route 495/90 "transportation hub" as well as the immediate access to service for commuters from communities North and South of that hub on Route 495 makes a strong argument that a regional station there would better serve the MBTA.

The proposed ridership in the year 2010 from Westborough is 210 and Southborough 150. These projections (Stone & Webster Report 1990) do not justify local stations in Westborough (640 cars) and Southborough (400 cars) . Elimination of these stations in favor of a regional station makes sense economically for the taxpayers as well as for properly planned development.

I am enclosing a copy of a "Citizen's Petition" which I submitted to the MBTA and Secretary Richard Taylor in June with 285 signatures indicating proposed site location concerns. I appeal to your expertise in making this a viable commuter project.

Sincerely,

Judith K. McCabe

Judith K. McCabe
15 Maynard St.
Westborough, MA 01581

Enc.
cc: MBTA

Re: M.E.P.A. Unit Project #9154
Millbury Station Plan

Warren S. Catherwood
10 President Rd.
Millbury, Mass. 01527

RECEIVED
SEP 17 1992
MEPA

9/16/92

Dear Sir: I am writing to your agency to request an inquiry into the location of my property and your proposed Millbury Station Plan.

I am enclosing the map of your Plan and I have encircled my house #1 and my Water Well which is a shallow, surface well from which I get all of my water to live with. The well is 49 feet from my house in the lowest part of my property near the brook shown on your map. I have been told by Mr Bishop in Millbury Planning Board that the parking lot will be 50' from my property line. That makes my well a little over 100 feet from the Parking Lot.

My concern is the pollution from the construction, surface and maintenance of the proposed Lot.

Well water comes from its surroundings. Especially a surface well which I have. The digging and grading for the lot could change water flow to my well. Putting a hardtop on the ground is going to take away ground seepage area that could be contributing water that help keep my well filled. I could loose the water table I now depend on and my well go dry.

When the Parking lot is in use. Automobile exhaust

trucks will be driving on it and parking on it for several hours a day. During the winter months here in N.E. all our vehicles accumulate road salt from traveling. These vehicles will shed their sand and salt in this parking lot during the day when it is warmer and the salted drainage from them will find its way onto the adjoining lands regardless of what type of a drain system you engineers put in, you know that. They plug up, freeze up and the rain will wash them into the fields. Check any of your present lots & see the condition next to the pavement, I have.

Now comes the snow & ice. If you salt the area as you do as the roads when its icy or a light snow — more and stronger salt goes onto the area paved and then drains into the exposed area nearby. You plow the deeper snow to the edges of the parking lot — most likely onto the unpaved ground so as not to loose parking spaces. These piles of salted snow will be very very heavy and then melting will certainly go into the ground beneath them and around them. It could be tons of snow in a bad winter and you cannot be sure where this polluted runoff will go once it goes into the ground.

I am scared. This is my home for 35 years & will be 69 years old 9/25/92 and I hope to live another 15 or so years in good health. I don't want to get poisoned because

some engineers put a plan on paper and say it is a safe project. When you fool with natures envirement there are always dangers. I think I am endangered. An endangered specie gets headlines and protection. I hope a human beings life is as importe as an owl's is. This project could be very life threatening for me. I am a disabled veteran of World War II. I have 2 Purple Hearts from wounds an survive I have no intention of getting my life shortened because of some engineers oversight or carelessness. I am quite ready to start a bleeding hearts campaign with any enviremental, newspaper, civil rights group or any other organization (or unorganized) & my state representater Mr Kolios who is up for reelection and might be willing to speak on my behalf.

Salt from cars & plowing. Anti freeze from cars cooling systems, gasoline and oil from cars engines can all come seeping into my well. 100+ feet is scary. One of ya Plans people talked with me at the RR track near my house and said 100 feet ought to be more than enough to be safe I confronted him with these facts and he was quite so cocky when I left the 4 of them there.

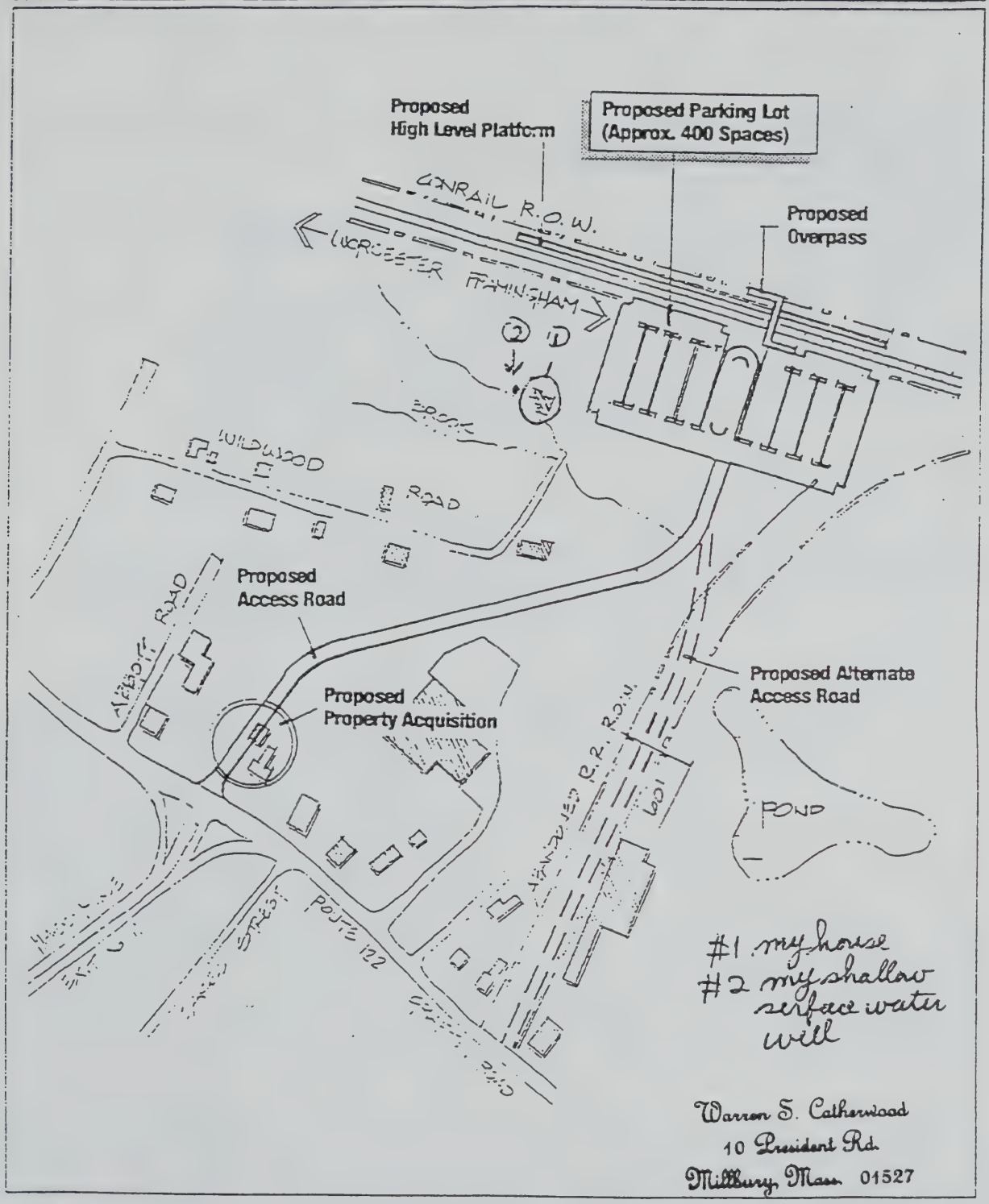
I would appreciate hearing from you

Thank you

Warren S Catherwood
508 752 8985

Warren S. Catherwood
10 President Rd.
Millbury, Mass 01527

125



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200 Feet

0 200

Station Plan / Millbury
Mass Turnpike Exit 11/Rte . 122

Prepared By:

EDWARDS AND KELCEY, INC.
Boston, Massachusetts

JD

Susan Tierney, Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, MA 02202

September 25, 1992

RECEIVED
SEP 28 1992
MEPA

Attention: MEPA Unit

Re: EOEA #9154, Worcester Commuter Rail Extension Project

Dear Susan Tierney,

I would like to comment on the Environmental Notification Form (ENF) for the above referenced project:

TRAFFIC:

The proposed MBTA station would be located directly across from the Massachusetts Turnpike (MASS PIKE), Exit 11, which is located on Route 122 in East Millbury. I am a resident of Oakes Street in East Millbury. As per my diagram (see attached), you will note my street runs parallel to the exit ramp. The main problem is the amount of traffic on Route 122 and that exiting the Mass. Pike onto Route 122 (S). This exit ramp joins the end of Oakes Street and causes many congestion traffic problems for residents of Oakes Street.

Over the past 15 years, I have seen a dramatic increase in traffic along Route 122 — so much so that it inhibits residents from exiting Oakes Street onto Route 122 NORTH and SOUTH. I believe the proposed MBTA station access road will further increase traffic and make it nearly impossible for residents of Oakes Street to exit onto Route 122. (It should also be noted that all the streets from Wheelock Avenue, Millbury to the Grafton town line are dead end streets. Oakes Street would not be the only

street in East Millbury affected by this proposed access road site.

WATER QUALITY:

I have walked the proposed MBTA station area and am concerned with the impact this station would have on the groundwater aquifer and an associated brook that traverses the site.

ALTERNATE SITING:

There is a proposed alternate site, presented by the Millbury MBTA Advisory Committee, that should be considered by MBTA and an EIR.

In conclusion, I would urge MEPA to require preparation of an EIR for this project.

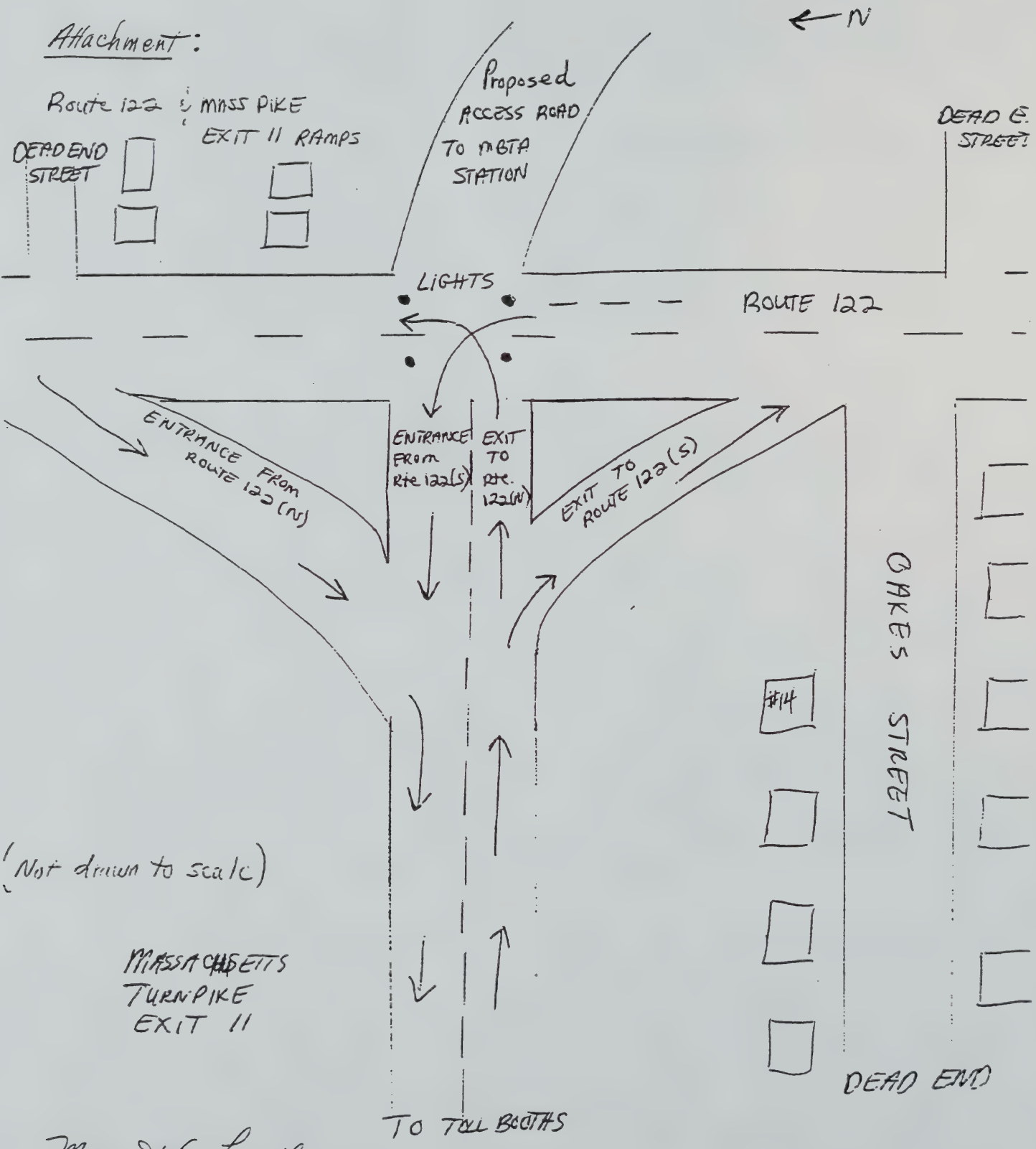
Thank you.

Sincerely,

Margaret G. Favalle
14 Oakes Street
Millbury, MA 01527

EOEA #9154

Attachment:



Margaret G. Lovellee
9-2-92

JD

8 High St.
Southborough MA 01772
September 20, 1992

RECEIVED
SEP 2 2 1992
MEPA

Ms Susan F. Tierney
Mass Executive Office
Environmental Affairs
MEPA Unit
100 Cambridge St.
20th Floor
Boston MA 02202

Dear Ms Tierney:

The purpose of this letter is to express my very strong support for the proposed MBTA station in Southboro.

As you well know, the area is located in a very fragile environmental and historic area of the Cordaville Section of town. I am sure you will take this into consideration.

It is necessary we have this stop because the private carriers are very expensive, infrequent and don't provide any public parking

Your time and cooperation in this matter will be gratefully appreciated.

Sincerely,

Frederick J. Quinn, Jr.

Frederick J. Quinn, Jr.

JD

RECEIVED
SEP 30 1992
MEPA

198 Southville Road
Southboro, MA 01772
September 27, 1992

Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge Street, 20th floor
Boston, MA 02202

Attn: MEPA Unit

Dear Secretary Tierney:

I am writing to express my concerns about the proposed MBTA site at the intersection of Southville Road and Route 85 in Southboro. I have attended two informational meetings conducted by the MBTA in Southboro in the past six months and am familiar with the proposed design of the station and the layout of the surrounding parking lots. I believe that the goal of increasing MBTA ridership to alleviate congestion and pollution is worthy, and I support mass transit. However, I strongly oppose the placement of a station at this site.

Proponents of the station accuse opponents of having a "not in my backyard" mentality. However, I don't think this correctly captures the nature of our opposition. If I lived in an area that had roads designed to handle the flow of traffic the station is expected to attract, I would be in favor of it. There is a certain appeal to the idea of having a station providing train service to Boston within walking distance of one's house. I am also not concerned about the likelihood of a large assessment on the town. I believe that mass transit is important enough to support it with my tax dollars. However, I believe it is a mistake for the MBTA to put a 400 car station in the middle of a rural, residential area for the reasons listed below.

The intersection of Route 85 and Southville Road is bordered by residential neighborhoods on the north, east and west sides and by a state park on the south side. Southville Road and Route 85 are very narrow two-lane roads with no breakdown lanes. Traffic on these roads is currently heavy during rush hour. No information has been forthcoming from the MBTA regarding the extent to which traffic flow will increase once the station is open. The roads in this area are not constructed for heavy traffic flow and the congestion that will inevitably develop will be a detriment to MBTA

ridership and will pose a threat to the saftey of children, joggers, and bicyclists in the local community.

I was also concerned to hear the MBTA representatives at the informational meeting say that they had received no firm commitment from their superiors that the station will be limited to a 400 cars, leaving the distinct impression that it is possible that it could be larger. Again, I believe it is ill-conceived to put a station designed to accomodate 400++ cars.

I urge the MBTA to reconsider its current plan. I think a regional station build near major north-south/east-west arteries is the only reasonable answer to providing mass transit service to our area. Someplace near the intersection of Route 495 and the Mass Pike is an obvious example. A large station with direct access from a major artery would have minimal negative impact on local communities and would channel traffic to roads designed to accomodate it.

Sincerely,

Jeanne Sholl

M. Jeanne Sholl

cc: Ms. Bartollini
Chair, Southboro MBTA Study Committee

RECEIVED
OCT 2 1992
MEPA

MEPA- File Number 9154
100 Cambridge Street
Boston, MA 02202

September 25, 1992

To: MEPA

I recently attended a meeting in Southborough, Massachusetts on the proposed MBTA Commuter Rail station for Southborough, Massachusetts. I wanted to let you know that I am not in favor of an MBTA station being constructed in Southborough, but I am in favor of regional stations being built along a major highway such as 495. The currently proposed station would add additional traffic congestion in the area of the site as well as the surrounding roads. I thought about traffic lights, but felt that would make the situation worse as cars would be sitting and idling in the area which cars do not do today. I understand a traffic study is part of the review process, but I feel it is impossible for a station to be built and not have the area adversely impacted by the addition of the station.

Sincerely,

Robert L. Banks Jr.
23 Richards Road
Southborough, MA 01772

cc: Barbara Gardner

MBTA commuter rail plan picks up local concerns

By Lisa Eckelbecker
Staff Reporter

WESTBORO — Residents and officials from communities slated to host stations on a proposed Worcester-to-Boston commuter rail line got a chance to sound off about their environmental concerns yesterday, telling state officials that things such as school safety and traffic should be studied.

One speaker called on the Executive Office of Environmental Affairs to deal with the plethora of concerns by designating the Massachusetts Bay Transportation Authority's proposal "major and complicated," a status that triggers a more finely tailored review.

"By doing that," said Kathy Bartolini, chairman of Southboro's MBTA advisory committee, "the interrelationship of the facilities could be looked at."

Bartolini and others listed their concerns about the MBTA's plans to build six commuter rail stations and lay new rail lines during a two-hour hearing at the Forbes Community Building. The hearing was called by the Massachusetts Environmental Policy Act unit as part of the process of reviewing the effects of the MBTA's plan.

DETAILED EFFECTS

Under the procedure, said MEPA representative Jollene Dubner, the MBTA will be required to file an Environmental Impact Report detailing possible effects to wildlife and the air, land and water. The "major and complicated" designation would alter the reporting procedure.

The MBTA has proposed an $80 million extension of commuter service from Framingham to Worcester that would add stops in Ashland, Southboro, Westboro, Grafton, Millbury and Worcester, according to Rocco A. Mancini, assistant director of construction for the MBTA. He said he anticipates design work will occupy the next 14 months, with construction beginning in January 1994 and service starting in mid-1995.

Mancini said the MBTA's current for tracks and stations remain preliminary and changes could alter issues such as the number of parking spaces at lots and the location and entrance of the Millbury station.

"We're at approximately ... 10 to 12 percent (of the) design stage," Mancini said. "So I just want to emphasize we haven't completed all the design."

Among those providing supportive comments were town planners from Grafton and Millbury, but they and others said the MBTA should accumulate more specific information about its proposal.

Several speakers questioned the costs towns would have to shoulder in contributing to the MBTA. Other suggestions covered the following towns and topics:

● Worcester — The MBTA has said a separate environmental report will be filed for Worcester pending further information on the rehabilitation of Union Station, but David J. Dunham, city environmental planning coordinator, urged the MBTA to include Worcester in the current report.

The separation goes against customary Environmental Affairs practices, Dunham said, and Worcester already has begun or completed history and traffic studies that could contribute to the review process.

● Millbury — Officials urged the MBTA to move the site for its proposed parking lot and entry road. Current plans call for a road off two-lane Route 122 to lead to a parking lot south of the tracks. The change would bring cars off four-lane Route 20 to a lot north of the rail line.

Other concerns focused on nearby residences and the effects on their private wells.

● Grafton — The MBTA has proposed erecting a 6-foot chain-link fence along the rail corridor, but officials sought answers on how a fence would affect the movements of wildlife, particularly in undeveloped portions of northern Grafton. Concerns also covered the MBTA's proposal to fill in a wetland area and replicate it elsewhere.

● Westboro — Traffic and its plications topped discussion fi Westboro representatives, part: larly in how it could affect child who walk to schools near the p posed Smith Valve Parkway stat and how it would affect driver: Route 9 and Otis Street.

Other issues covered wildl nearby wells, noise levels fr some of the MBTA's older tra and the status of Hoccomo Pond.

● Southboro — Bartolini s: much of the initial informat: about the MBTA's proposal, colle ed for feasibility studies, rema: uncollected for the Southboro s ment. She suggested that the MB' provide information on the lo: term effect a train station co have on local property values, a she encouraged the construction noise barriers and bike paths.

NC
JD

September 21, 1992

Susan F. Tierney
Secretary of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202
Attention: MEPA Unit

Dear Secretary Tierney:

I am writing this letter in behalf of myself and my family. I do strongly disagree with the MBTA's selection of the Southboro site. This site as does most of the railways that paraliel the Sudbury River posses a great threat to the already devastated condition of this natural wetlands environment. The pond next to the proposed parking lot along with the spillway are in a sad state from abuse of its Industrial abutters, and can only be hurt by increased drainage of contaminated waste water, and of course salt. This section of wetland is home to many water fowl that would be impacted by the increase of noise pollution. The other creature that is greatly impacted is the citizens of Southboro. The increased traffic that will be as a direct result of this station will make an already bad problem worst. The Finn primary school is located just blocks away from the site and the increased traffic would pose a proportionate risk to commuting students. This would in fact hold local residents hostage while rail commuters enjoy a sort of legalized speeding that is afforded to most rush hour travelers.

I would suggest that along with the proper engineering that is needed before an intelligent selection is finalized by the MBTA, and not just a location of a couple of cheap lots that border the rails, that a complete study of the surrounding ecological and living environment be done. It is good for every citizen to do their part in reducing pollution, but lets not just shift the harm to a much more sensitive environment.

Thank you,

Stephen L. Dixon
2 Bridge Street
Southboro, MA 01772

FROM THE DESK OF

Phone: 366-9794

30

Dr. Timothy B. Hopkins

Dr. & Mrs. Tim Hopkins
21 Olde Meetinghouse Road
Westboro, MA 01581

RECEIVED
SEP 11 1992
MEPA

Susan Tierney
Secr of Environmental Affairs
100 Cambridge St
Boston MA

Dear Ms Tierney:
We would like to request that an EIR be required for the Worcester Commuter Rail Extention Project. Specifically this needs to address regional planning, traffic impact, pedestrian safety, noise and light pollution, and any effect on safety for the ~~Westboro~~ Middle School on Fisher Street.

Yours truly
Tim Hopkins
Sue Hopkins

Sept 4, 1992

Dear Mrs Sierney

I would like you to consider ~~every~~ requesting an Environmental Impact Report on the Smith Valve Site.

This site in Westboro is designated as an MBTA stop.

Of special concern is: traffic impact, noise pollution pedestrian safety (no sidewalks on approach roads) and regional planning.

Sincerely yours

Elaine Santoro

RECEIVED
SEP 8 1992
MEPA

Dear Mr. Tierney:

I request an E.I.R be required for the Worcester Commuter Rail Extension Project in Westboro

Please also address the issues of Regional planning, Traffic impact, noise and light Pollution.

Most important Pedestrian Traffic.

Thank you

Adele S. Bottchelle
12 Beach St.
Westboro, Mass

RECEIVED
SEP 8 1992
MEPA

Sept 6, 1992

RECEIVED
SEP 11 1992
MEPA

Dear Ms Tierney,

I write in regard to the Worcester Commuter Rail Extension. Will you please have a EIR done on this project, and also address these issues: regional planning, traffic impact.

Thank you for your concern for the interest of the Taxpayer.

Thomas Thompson
P.O. Box 995
Hamilton Ma 01936

RECEIVED
SEP 10 1992
MEPA

Mrs. Robert B. Tufts, Jr.
17 Whitney Street
Westborough, Massachusetts 01581

September 4, 1992

Dear Ms. Tierney,

As residents of Westborough we are writing to express our opposition to the site of the proposed MBTA station on the Smith Valve property off Otis St.

These residential streets are not suitable for handling increased traffic, especially since Fisher Street, Mill Road, and Maynard Street do not have sidewalks. The town's middle school is on Fisher St and many children walk to school on these streets.

Our mother lives at 28 Maynard Street and when we visit her it is apparent that the traffic is increasing each year. With a train station just up the road, the traffic would be much worse. But it would be dangerous for the large number of children who walk on these roads.

Please help us to stop this choice of an MBTA site. A station belongs out of town, near Route 9 or 495, or the Mass. Turnpike.

Thank you,

Bob and Anne Tuft

Sept 4, 1992

RECEIVED
SEP 8 1992
MEPA

Susan F. Tierney
Dear Lady

In regards to the MBTA Project supposedly being arranged in Westboro, I feel we need an EIR report of inspection not only for what usually is done, but take into consideration the impact on our Streets which at present could not deal with the added traffic that would be incurred if this project was allowed Route 9 would be even more affected and it is having troubles dealing with it now

We do not need anything Else to have to spend our money on. The reconstruction would very expensive and cause a hardship on the

people of Westboro.
Please ask for an
EIR report as soon as
possible.
There are more things
it would have an affect
on but I am sure you
will see the right thing
will be done.
Thank you. I remain
Yours truly
Dorothy McMahon

116 Ruggles St
Westboro
Mass. 01581.

RECEIVED
SEP 10 1992
MEPA

Sept. 8. 1992.

Dear Ms Tierney.

As a resident of Westboro I am very concerned about the impact of the Worcester Commuter Rail Extension Project. I would like to ask that a Environmental Impact Report be required before going ahead with this project.

Also that the following issues be specifically addressed — regional planning - traffic impact - pedestrian safety noise and light pollution.

I think in fairness to the residents to the Town of Westboro - these issues must be given very serious attention as it will in all probability change the whole structure of the Town.

Yours sincerely
Elizabeth Moss.

JD

RECEIVED
SEP 3 1992
MEPA

28 Brook Street
Shrewsbury, MA 01545
Sept. 2, 1992

Dear Mr. Tierney,

I am writing to you about the proposed siting of a railroad station at Otis St and Smith Valve Parkway, Westboro.

I want to express my opposition to this site. It will increase the traffic on the country roads in Shrewsbury too. There are many children in the area who ride school buses. There will be a dangerously large increase in traffic and I feel this is a great concern.

We also want to maintain our country atmosphere. There isn't much left in our area anymore. The area of Fruit Street and 495 Interstate will have a far less impact on the area towns and attract a greater

number of riders. I feel we do need rail service. I am just opposed to the Smith Vale Parkway Station.

I would appreciate your consideration of the opposition of the neighborhood. Perhaps if you were to visit the area you would see the reasons for our concerns. Thank you.

Sincerely
Thelma Leendin

RECEIVED
AUG 31 1992
MEPA

JD

14 Maynard St.
Westboro, Ma. 01581
August 26, 1992

To Governor William Weld,

I am opposed to the Worcester Rail Extension Project. I do not feel Massachusetts should be giving the defecit - laden MBTA more of our tax dollars for a project that is not even proven to be necessary. Ridership, from at least Westboro, was based on projected data from a census, no poll of residents occurred to determine who would actually use the train daily for commuting (there will not be any weekend service). Anyway, where are the jobs in Boston for people to commute to?

More closely, I oppose the project for my town of Westboro for the following reasons:

1. Our schools, police, fire, etc. will have to compete for our tax dollars with the assessment from the MBTA. Is a Proposition 2 1/2 override in Westboro's future?

2. The six hundred car lot at the Smith Valve (Otis St.) site will create increased traffic in old, established neighborhoods that have narrow , windy roads. Though the site is accessible from Route 9, the side streets would be used to avoid the traffic and the lights on Route 9. Furthermore, our Middle School is located on Fisher St. which connects to Otis Street. Children walk through these neighborhoods near the site to school.

3. I am told that the noise from the commuter trains is no greater than what we are accustomed to from the freight trains. However, the freight trains run infrequently. The frequency and constancy of commuter trains is what concerns me. The abutting homes will have no peace.

4. Lastly, the air quality for abutting properties will decrease due to the increased diesel fumes. These trains are in our back yards, where our children play and attend school.

An Environmental Impact Report (EIR) must be completed for the Westboro site. If done properly, it will show the Smith Valve site has too great a negative impact on Westboro.

Sincerely,

Elizabeth M. Colbert

Elizabeth M. Colbert

cc: Executive Office of Environmental Affairs
Secretary of Transportation, Richard Taylor
Senator Matthew Amorello
John J. Haley Jr., MBTA General Manager

14 Maynard St.
Westboro, MA 01581
Sept. 15, 1992

My concerns for the neighborhoods surrounding the Otis St. site, and Westboro as a whole are as follows:

1 Decreased air quality due to increased diesel fumes (more trains running on the tracks). These trains are in our backyards and near our town's Middle School.

2 Increased noise pollution due to frequent and constant stream of train traffic. The freight trains that run now do so infrequently during the day. The commuter trains will run constantly from 6AM - 9AM, 4PM - 7PM and also

sporadically during the day, we will have no peace in our yards and homes.

3. Increased pollution from cars driving through our neighborhoods to avoid Rte. 9 traffic + lights to Otis St. Also, there is a safety concern for those who walk to school, etc. through our streets with no sidewalks. (Neighbors on Maynard St. do not want sidewalks because too many trees would have to be cut down, and it would also ruin the appearance of the street)

4. Finally, the assessment from the MBTA concerns me. What needs in Westboro will have to be overlooked

so our tax dollars can pay the MBTA's assessment?

I sincerely hope an Environmental Impact Report will be performed for Westboro, and the project as a whole.

Elizabeth Colbert

SECRETARY EXECUTIVE OFFICE
OF ENVIRONMENTAL AFFAIRS
20TH FLOOR
100 CAMBRIDGE STREET BOSTON MA 02203
ATTENTION MEPA UNIT

GERALD VISCARDI
37 ARCH ST
WESTBORO MA. 01581

RECEIVED
01-Sep-1992
SEP 15 1992
MEPA

RECEIVED
SEP 1
MEPA

RE PROJECT EOEA # 9154
MBTA STATION WESTBORO MA

Dear Secretary

I am against the siting of the MBTA station on Smith Value Parkway in Westboro for several reasons. The added traffic on local roads that are not designed to handle the current traffic levels. This will cause dangerous situations for the children who live in the area either as they walk to school or wait for the buses. Maybe on dry sunny days there won't as much of a danger but we must anticipate snowy/icy days when the schools are open. I can see some commuters who are late for their train traveling to fast for the conditions and losing control. Will this station be worth it if one child gets hurt or worse? Why should Westboro absorb the cost of fixing it's streets to accommodate people from other towns? As well as the additional costs that will come from policing the area?

I also can only imagine major environmental impacts on the local area. The pond next to the proposed site, I would think would be adversely affected by the construction of not only the station but the additional track that is needed. The train runs right along the water. The additional trash burden on the town from 600 commuters dropping their trash out of their cars. Why does Westboro need this. I see the Reading MA site where my in-laws live. The area is a mess. Why does Westboro have to absorb this?

Please come out to the site during rush hours 3-5pm and sit and watch the traffic at Otis and Route 9 as well as Smith Value to Otis. Think what 600 more cars will do to the Area.

I ask you to reject the site in Westboro for the expansion of the MBTA.

Gerald Viscardi

Gerald Viscardi

cc. MASS BAY TRANSPORTATION AUTHORITY
10 PARK PLAZA
BOSTON, MA. 02116

ATTN: WORCESTER COMMUTER RAIL
EXTENSION PROJECT

JD

DAVID LEE & ASSOCIATES
Established 1971

Adams-Fay House
20 Fruit Street, Hopkinton, MA 01748-1006

Tel: (508)435-4146

September 8, 1992

RECEIVED
SEP 18 1992
MEPA

Ms. Susan F Tierney
Secretary of Environmental Affairs
100 Cambridge Street. 20th Floor
Boston, Massachusetts 02202
Attn: MEPA Unit

Dear Secretary Tierney

This letter is in response to your request for public comment on the MBTA's Worcester Commuter Rail Extension Project (Framingham to Worcester Line). I have reviewed the MBTA's Environmental Notification Form (ENF) for this project and have several concerns that I shall address in this letter.

Regional Station

One of my prime concerns is the MBTA's long term goal of siting a regional station at the junction of Interstate Route I-495 and I-90 (the Massachusetts Turnpike) in Westboro. As you may be aware the town of Hopkinton opposed the Fruit Street site and still does, because of environmental concerns, traffic concerns, and finally cost concerns.

Environmental Concerns

Our environmental concern is that this area (Fruit Street, Old Flanders Road, or Flanders Road) is within a few hundred feet of the Sudbury River and the Cedar Swamp. These are extremely environmentally sensitive areas that must be protected now and in the future. This alone warrants that the MBTA be required to file an EIR and follow the full MEPA review process. Any siting of a station within the Sudbury River zone demand that the full process be followed and there is at least one proposed station in the zone (Southborough) and if the MBTA continues to pursue the regional station in the future that station will most likely be in the zone.

Traffic Concern
The traffic concern is obvious in that Fruit Street, presently a very narrow, rural, scenic road will become the subject of very heavy commuter traffic from the southern areas beyond Hopkinton (Upton, Milford, etc.) Commuters wishing to "pick up the T" at Southborough will flood this road as the only convenient route from the south to Flander Road (in Westboro)/Southville Road (in Southborough) on the way to the Southborough Station (at the present time.) In the future, if the MBTA persists with the regional station in the I-495/I-90 area (at Fruit Street and Old Flanders Road) this situation will worsen.

Cost Concern
Finally costs concerns are based on statements made at the Tufts/Grafton Press conference held in August where it was stated that the I-495/I-90 station and Interchange work would cost as much or more than the entire total present extension project. Is it wise to even consider in the future extremely costly and environmentally unsound construction projects?

It is my opinion that we should get the present project going but let us not forget that there are certain processes that should and must be adhered to, that of the EIR/MEPA process. As for the future station citing, the MBTA should see how the ridership develops, and then see if a regional station is really necessary. If it is the EIR/MEPA process should again be strictly adhered to.

Thank you for the opportunity to review and comment on the ENF and I hope that you will continue to send this type of material to the public for comment in the future.

Sincerely;

David S. Goldman, P.E.
President/CEO
and
Associate Professor of Engineering Technology
Northeastern University
and
Resident of Hopkinton

cc: Jane Chmielinski
Manager of Environmental Affairs
MBTA
Design, Construction and Real Estate Division
Ten Park Plaza
Boston, MA 02116

Hopkinton Board of Selctmen
Hopkinton Planning Board
Hopkinton Conservation Commission
Hopkinton MAPC Representative (Penny Manchester)
Senator Matthew Amorello
Representative Barbara Gardner
Sudbury Valley Trustees
Board of Selectmen Southborough

D

Susan Tierney
Secretary of Environmental Affairs
100 Cambridge St
20th floor
Boston MA 02202
Attn: MEPA Unit

RECEIVED
SEP 15 1992
MEPA

Please be advised that I request that an EIR be required for the Worcester Commuter Rail Extension Project that specifically address regional planning, traffic impact, pedestrian safety, noise and light pollution.

This information would be in addition to the other requirements of an EIR.

Thank you for your consideration of this request.

Sincerely,
Roger E. Harrington
Member, Hopkinton Board of Appeals
Member, Hopkinton Planning Board

102 Wood Street
Hopkinton MA 01748

JD

September 17, 1992

Executive Office of Environmental Affairs
100 Cambridge Street - 20th Floor
Boston Massachusetts 02202

RECEIVED
SEP 21 1992
MEPA

Attn. MEPA Unit

Re. MBTA Worcester Commuter Rail Extension
Project ENF - EOEA # 9154

Dear Ms. Dubner Baker:

During filled a few ENF's with your office, I offer the following comments about the above-mentioned ENF as to what I perceive to be major short-comings:

1) Segmentation - I realize the MBTA would like to fast-track this project. However, the issues surrounding the Union Station terminus and the regional station are integral components of the project and ergo, should be addressed in the forthcoming draft EIR. The Worcester Environmental Planning Coordinator spoke at your Walkthrough meeting of September 15

1992 that segmentation relative to Union Station be not permissable. Others, e.g. C. Bartolini (Southborough) requested inclusion of regional station sites' issues in the draft EIR. I believe, as above, that all issues relative to each of Union Station and the regional station sites must be addressed in the project's EIR.

2. As you are aware the Cedar Swamp ACEC was the first one in the state. It was designated by Secretary Murphy due to, primarily, impacts generated by construction of the Penn Central (now part of Conrail) piggy-back site along with other encroachments on the swamp. Figure 1, entitled "Typical Track Roadbed Cross Section" shows fencing and drainage swales at elevations below the grade of the existing track roadbed. If this is correct, this work would be done in the Cedar Swamp ACEC. Also, not shown is the location of additional signals; these also would not be at roadbed grade. I believe the traversing of Cedar Swamp ACEC should

be addressed in the draft EIR.

3. References under III D. Water Quality and Quantity, especially 2 "introduction of pollutants" state "NO". However IIE shows an "X" for Water Pollution. How can they say "NO" and later say "impacts are minimized"; that's not a "NO"?

4. I strongly believe wetlands impacts should include track roadbed work also, and ancillary facilities e.g. signals, fencing, shrubs, etc. Therefore I believe the 0.9 acreage figure is over 1.0 acres and should be addressed.

Thank you for the opportunity to comment upon the ENF. I further believe many of the comments provided to you at your Westborough meeting had validity (Lot of them)

Finally, it was good to see each of you again.

Sincerely,

Gordon E. Marquis
151 Fruit Street
Hopkinton MA 01748

cc. Hopkinton Selectmen, Town Planner, MBTA Study Committee
L. Jones, Westborough

NB

RECEIVED
SEP 28 1992
MEPA

15 Hilltop Drive
Millbury, Massachusetts 01527
(508)757-1126

September 22, 1992

Susan F. ~~Tierney~~, Secretary
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, Massachusetts 02202

Attention: MEPA Unit

Re: EOEA # 9154, Worcester Commuter Rail Extension Project

Dear Secretary Tierney:

For the record, I would like to submit the following comments made by me at the MEPA hearing held on September 15, 1992 in Westboro, Massachusetts. On the day of the hearing my comments were written in longhand and I decided not to submit them until they were typed.

"My name is Joseph R. Bianculli, a member of the Millbury MBTA Advisory Committee. I would like to offer a few comments relative to the proposed MBTA station in Millbury.

I have no objection to the proposed location of the station, my objection to this project is in the proposed access from Grafton Road (Rt122) in East Millbury. Grafton Road has far exceeded its traffic capacity. The MBTA Environmental Notification Form has a 1989 estimated average daily traffic count of 15,743. On September 24, 1991 a traffic count taken by the Central Massachusetts Planning Commission was 25,268 vehicles. This equates to a 60% increase in just two years.

With the exception of Wheelock Ave, all streets abutting Grafton Road are dead end streets, and as a result causes much difficulty entering on to and exiting from Grafton Road. There is also a high frequency of accidents in the area because of the increased traffic. Attempts by residents of East Millbury to get relief from the problems of traffic has not been successful to date. The solution to this concern can be resolved by the MBTA by accepting a proposed access on Rt 20 in Worcester. This access would place the 400 car parking lot northerly of the tracks, eliminate the proposed pedestrian overhead walkway at a substantial savings, and provide expansion of the parking lot. The access and parking lot would be in an industrial zoned area, where on the other hand, the MBTA proposal is through and in a residential area. To consider increasing the traffic count upwards of 1,000 vehicles on Grafton Road would be

irresponsible, so therefore I ask that you condition your decision based on the Rt 20 access only, and not consider the Rt 122 access.

Also, the non-existence of restrooms at the Millbury station should be addressed. Since the area lacks any type of public restroom within a reasonable distance, I can envision problems in the future for commuters who are waiting for the train, or waiting to be picked up by private car or public transportation. The lack of restrooms should be considered.

Lastly, Mr. Mancini mentioned joint development potential. The proposed access at Rt 20 would allow joint development potential for the area northerly of the tracks.

In closing, I ask that you give the utmost consideration to the residents of East Millbury. Thank you."

Sincerely,

Joseph R. Bianculli

Joseph R. Bianculli

Association for Public Transportation, Inc.
95 Berkeley Street, Suite 633
Boston, Massachusetts 02116
(617) 482-0282

RECEIVED
OCT 1 1992
MEPA

September 29. 1992

Susan Tierney
Executive Office of Environmental Affairs
100 Cambridge St., 20th floor
Boston, MA 02202

Re: EOEA # 9154

Dear Secretary Tierney,

The Association for Public Transportation (APT) is a 17-year-old, non-profit organization that supports public transportation in and around Boston. APT is pleased to comment on the proposed commuter rail extension to Worcester.

Commuter rail service to Worcester will help link the two biggest cities in New England physically and economically. The project should proceed quickly, but must take into account the tremendous impact on the neighborhoods in which the stations are proposed. The MBTA must maximize the number of parking spaces at each proposed station while balancing the needs of abutters. High-quality bicycle facilities should be included at each proposed station, thus maximizing patronage at the station.

We also recommend that a Citizens Advisory Committee be established to work out final station-location plans, station-access issues, and station- and parking-lot design. APT requests that it be considered for inclusion on this Advisory Committee.

We look forward to this project going forward. Thank you for the opportunity to comment.

Sincerely,

Stephan Chait

Stephan Chait
President

SC/alm